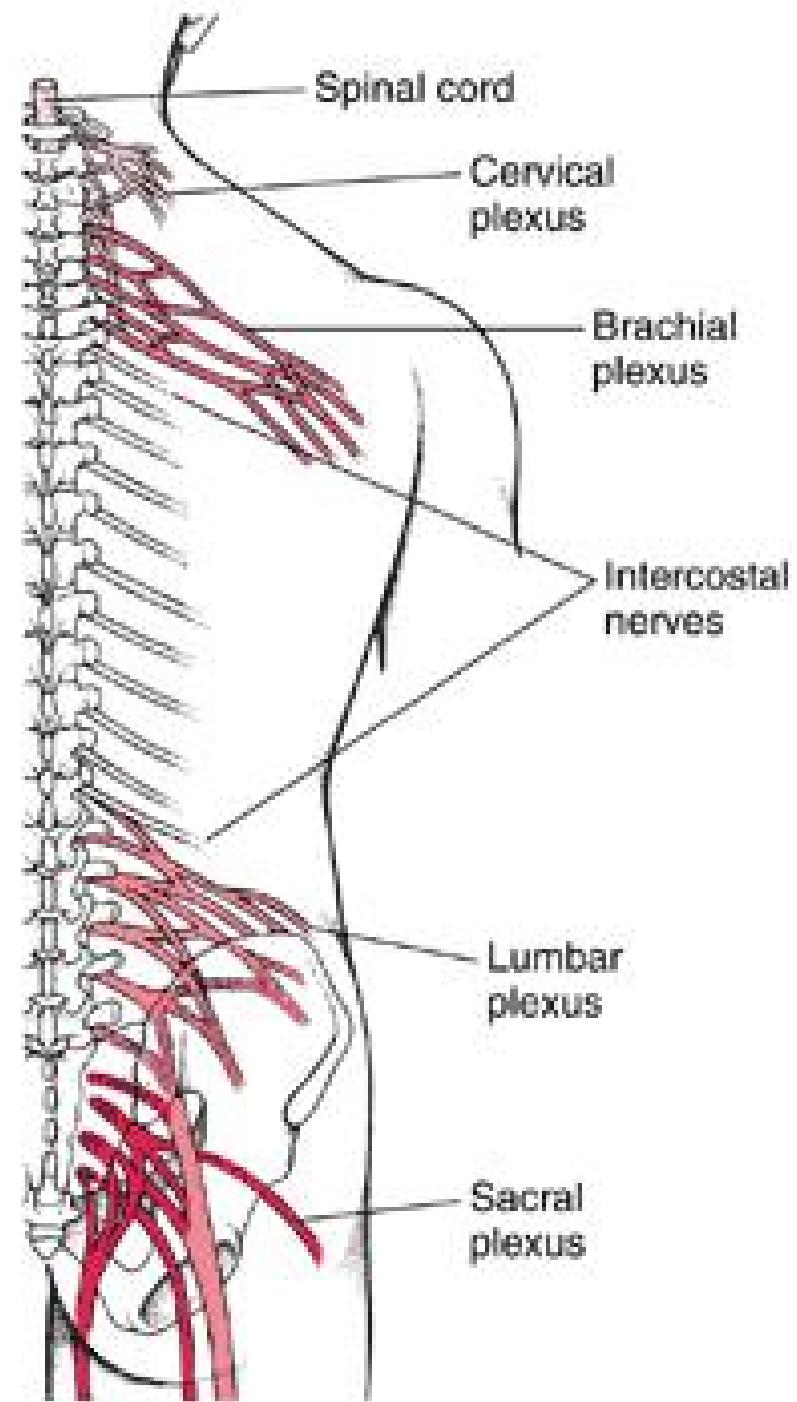


Peripheral Nerves & Muscles

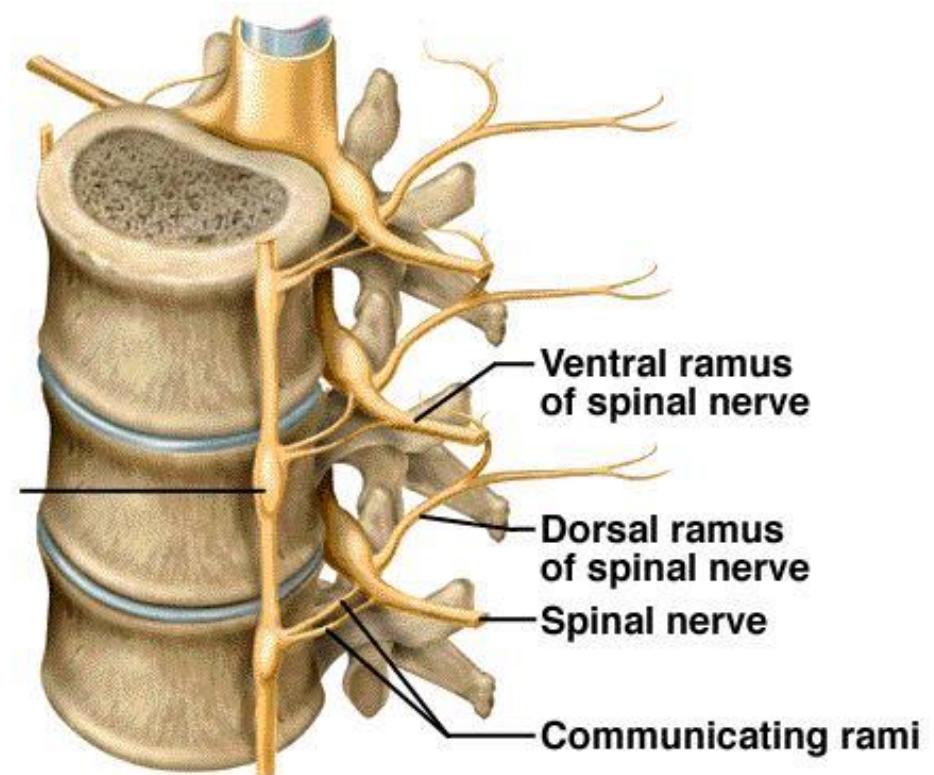
Cervical and Brachial plexus

- A **nerve plexus** is a network of interwoven nerves,
- Nerve fibers from different spinal nerves are sorted and recombined in plexuses, so that all fibers going to a specific body part are put together in one nerve.
- Four nerve plexuses are located in the trunk of the body.
 - **cervical plexus** provides nerve connections to the head, neck, and shoulder.
 - **brachial plexus** provides connections to the chest, shoulders, upper arms, forearms, and hands.
 - **lumbar plexus** provides connections to the back, abdomen, groin, thighs, knees, and calves.
 - **sacral plexus** provides connections to the pelvis, buttocks, genitals, thighs, calves, and feet. Because the lumbar and sacral plexuses are interconnected, they are sometimes referred to as the **lumbosacral plexus**.
- The spinal nerves in the chest do not join a plexus; they are the **intercostal nerves**, which are located between the ribs.



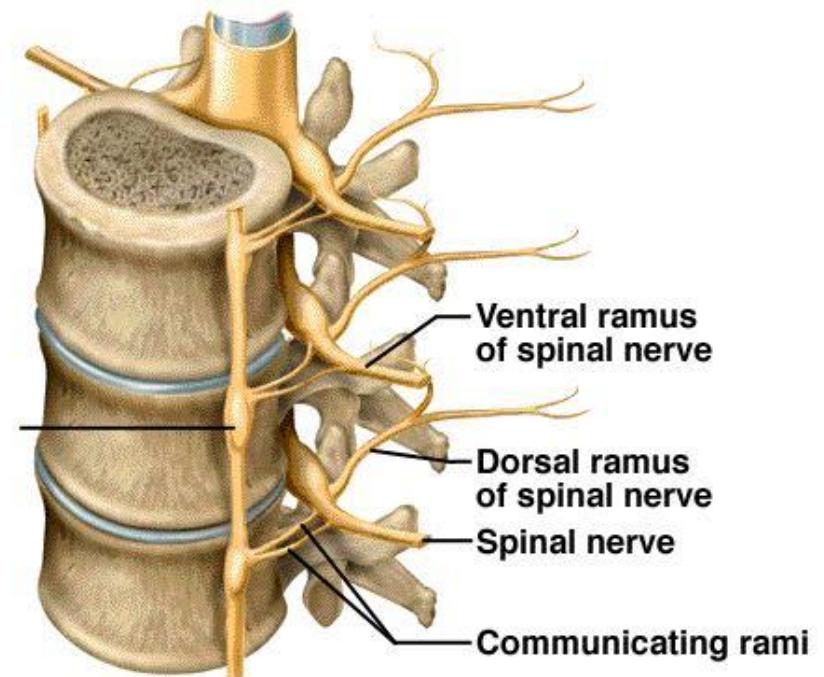
Spinal Nerve

- distal to the vertebrae, the spinal nerve branches into the **dorsal** and **ventral ramus** and a small **meningeal branch**



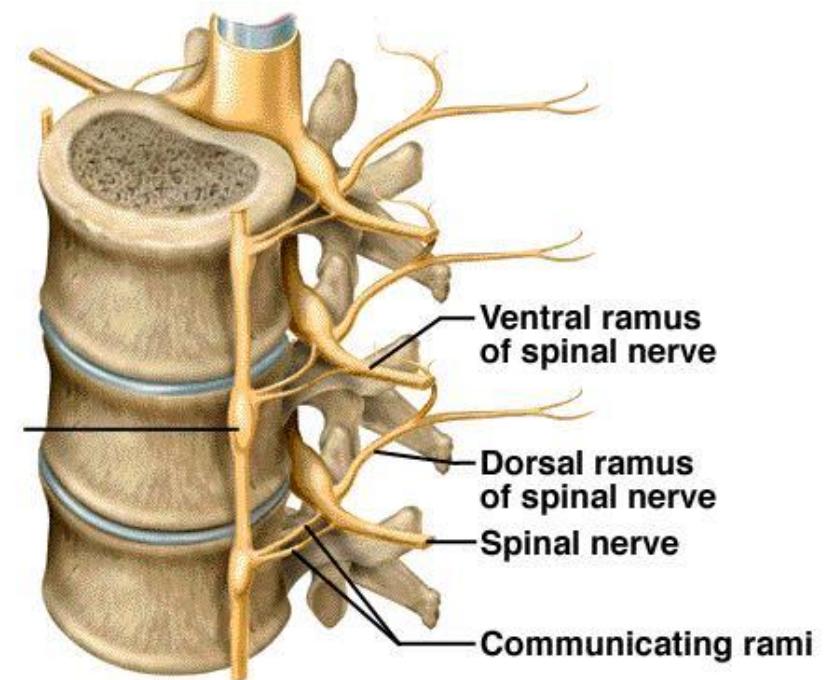
Spinal Nerves

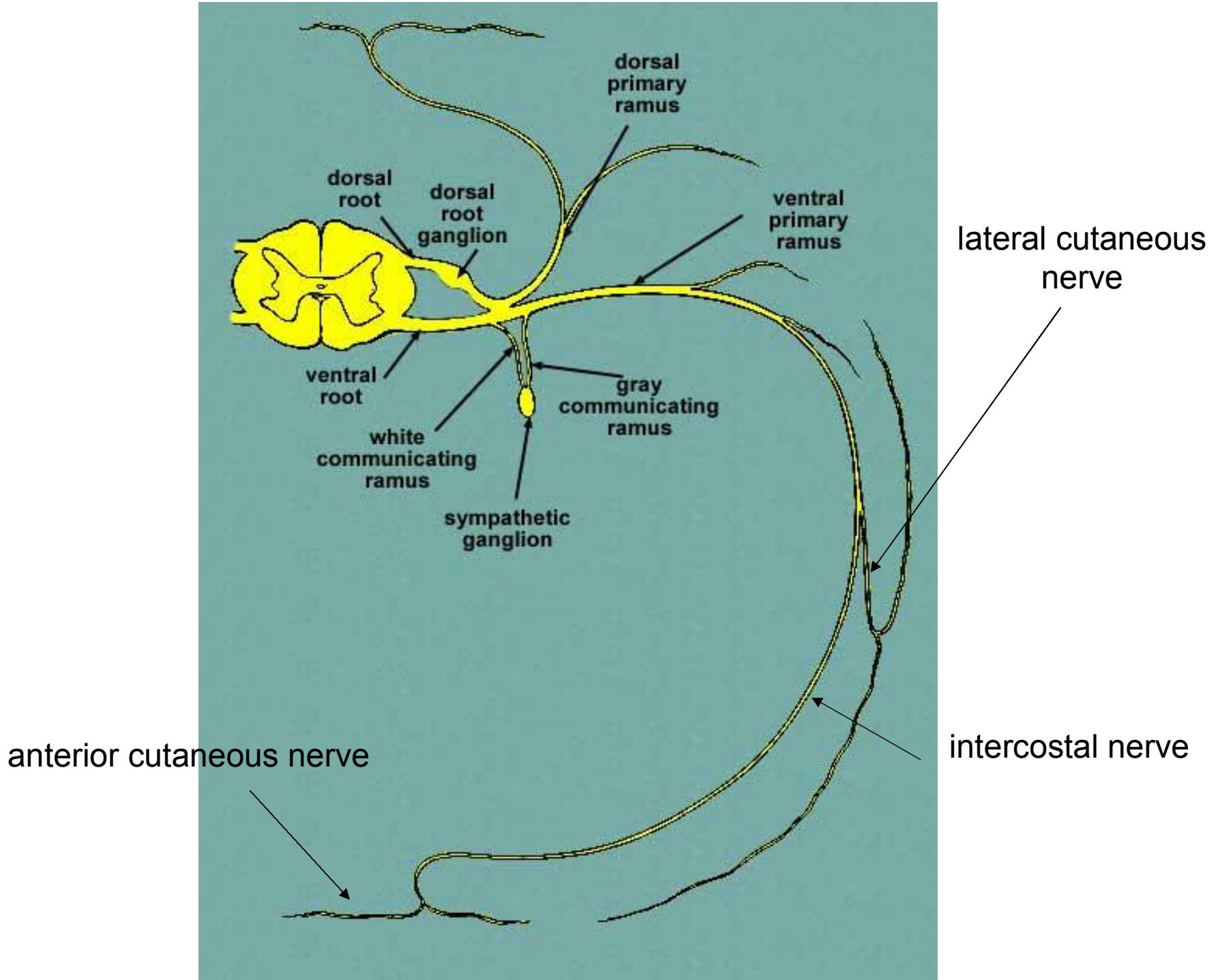
- **Meningeal branch-** reenters the vertebral canal and **innervates the meninges, vertebrae, and spinal ligaments**
- **Dorsal ramus-** supplies motor and sensory innervation of the skin and muscles of the back. It does not contribute to limb innervation or plexus formation.



Spinal Nerves

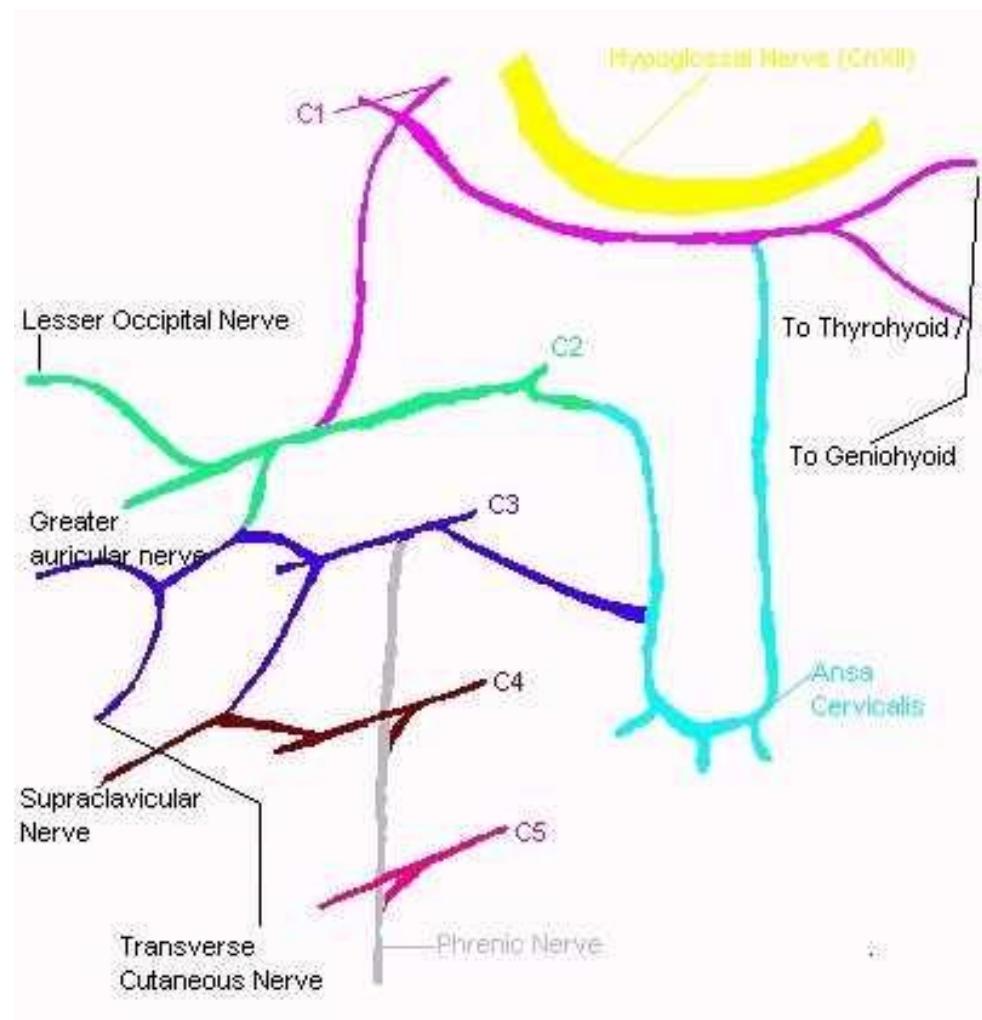
- **Ventral ramus-** innervates the **ventral and lateral skin and muscles of the trunk** and gives rise to the nerves of the limbs
- ventral ramus differs from one region of the trunk to another
 - thoracic region- forms **intercostal nerves** to innervate the skin and intercostal muscles, internal oblique, external oblique, and transversus abdominis
 - **other ventral rami form the nerve plexuses**





Cervical Plexus

- formed from the anterior rami of the first four cervical nerves (C1-C4).
- is located lying on **scalenus medius** and its anterior side is covered by **scalenus anterior**, the prevertebral fascia, and the internal jugular vein within the carotid sheath.



Cervical Plexus (cont)

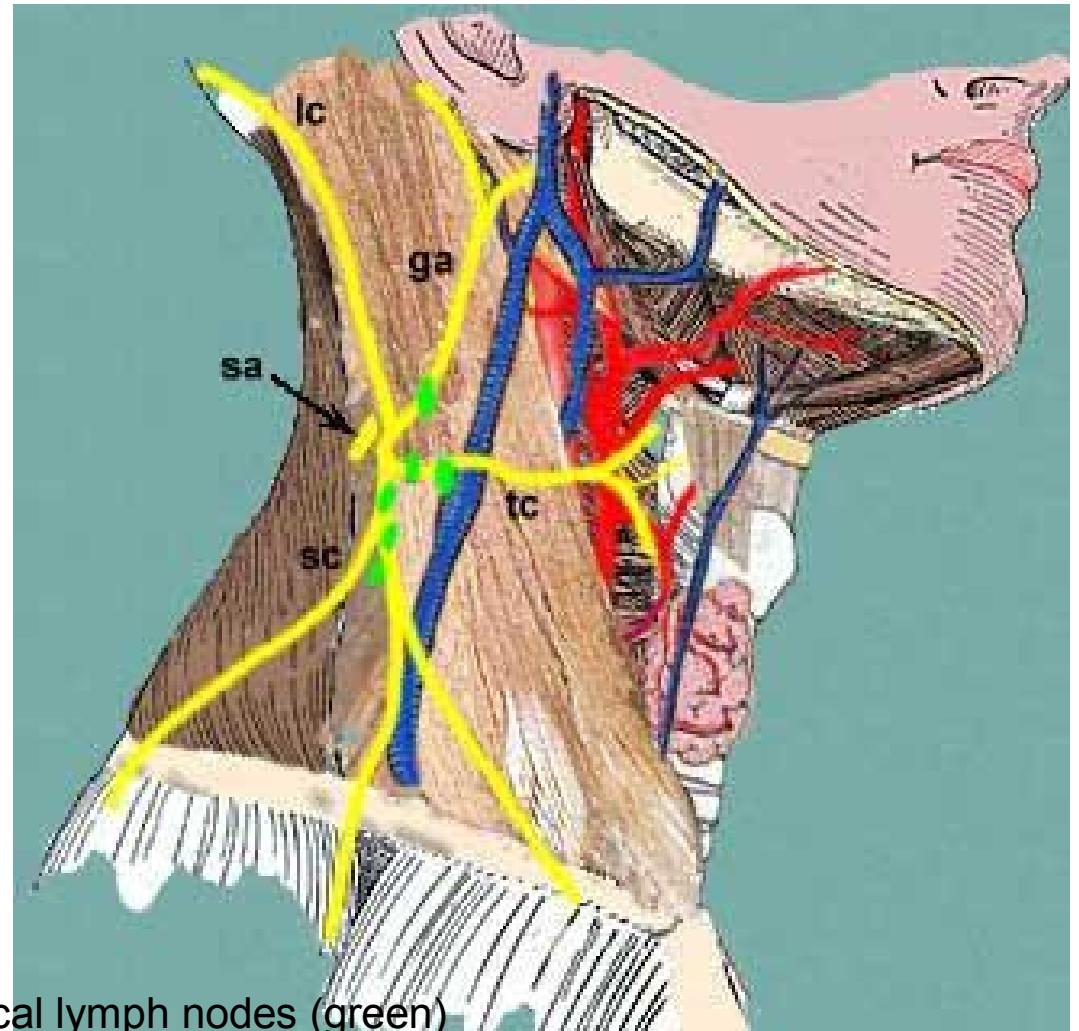
Cutaneous innervation of head and shoulder area

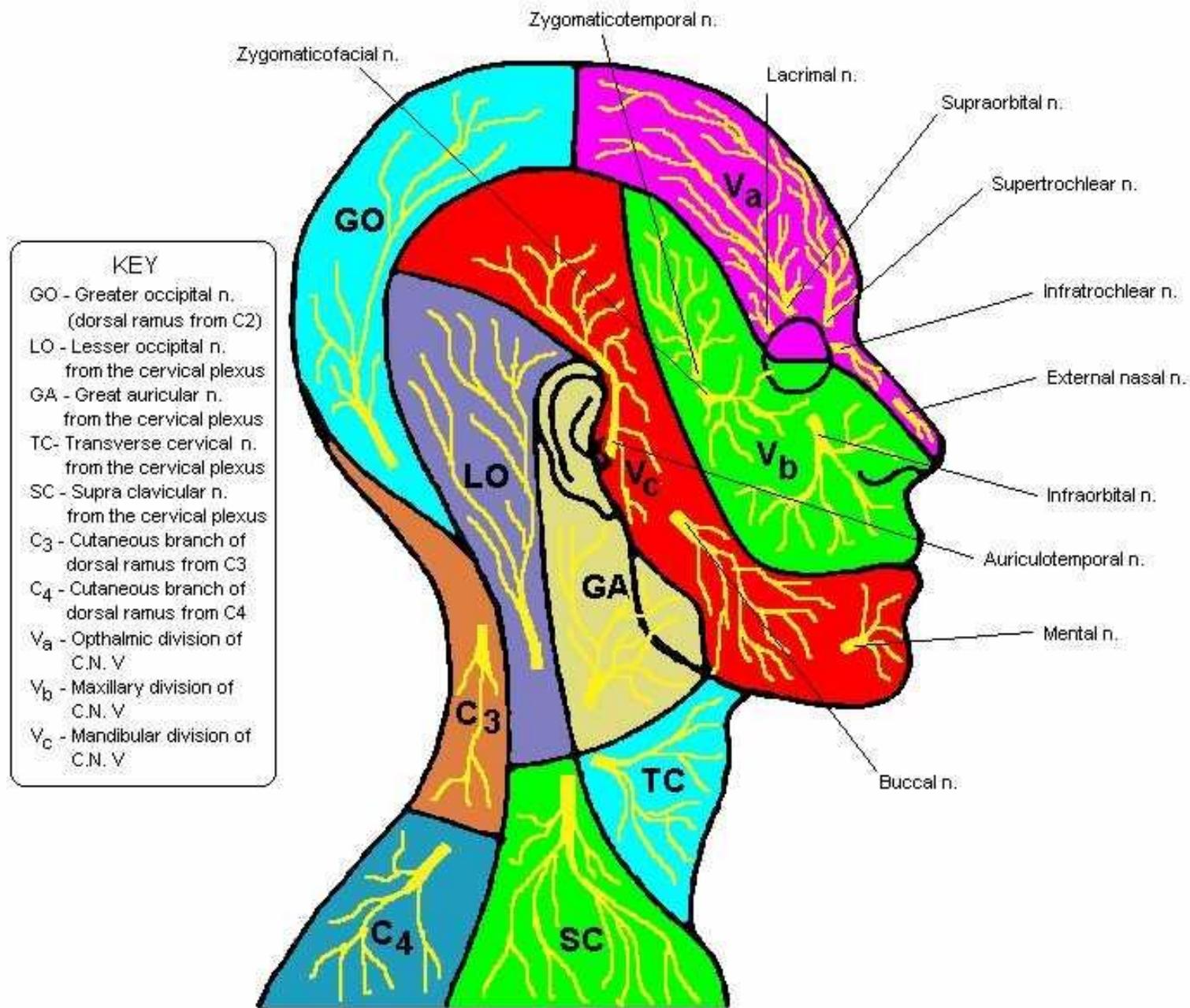
- **Lesser Occipital Nerve**
(C2 & C3)
- **Greater Auricular Nerve**
(C2 & C3)
- **Transverse Cutaneous Nerve**
(C2 & C3)
- **Supraclavicular Nerves**
(C3 & C4)

Muscular innervation

- sternocleidomastoid (C2 & C3)
- levator scapulae (C3 & C4)
- trapezius (C3 & C4)
- portions of scalenes
- Genohyoid (C1)
- Thyrohyoid (C1)

external jugular vein (blue) ,superficial cervical lymph nodes (green)
lesser occipital nerve (lc), great auricular nerve (ga), transverse cervical nerve (tc)
supraclavicular nerves (sc), spinal accessory nerve (sa)

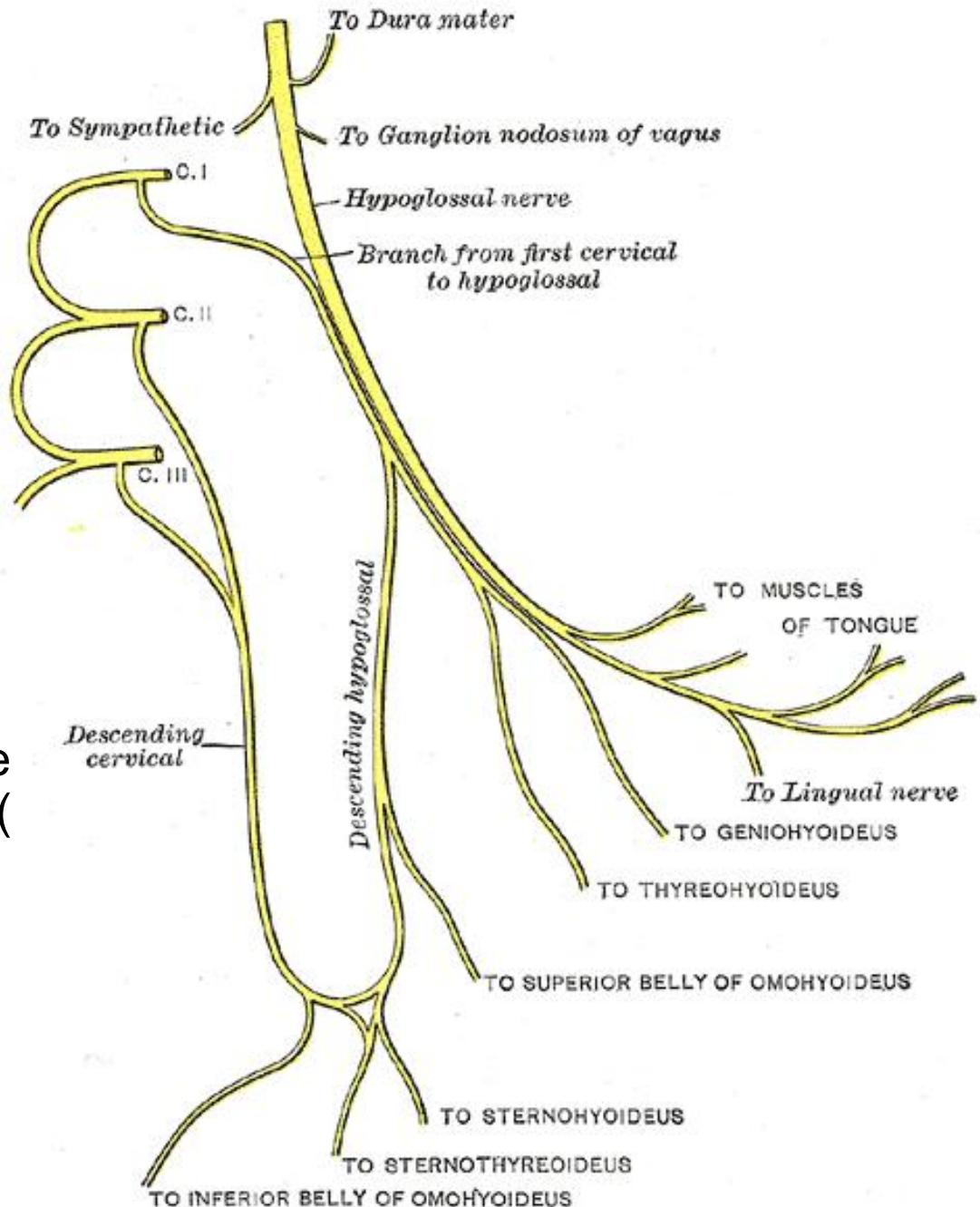


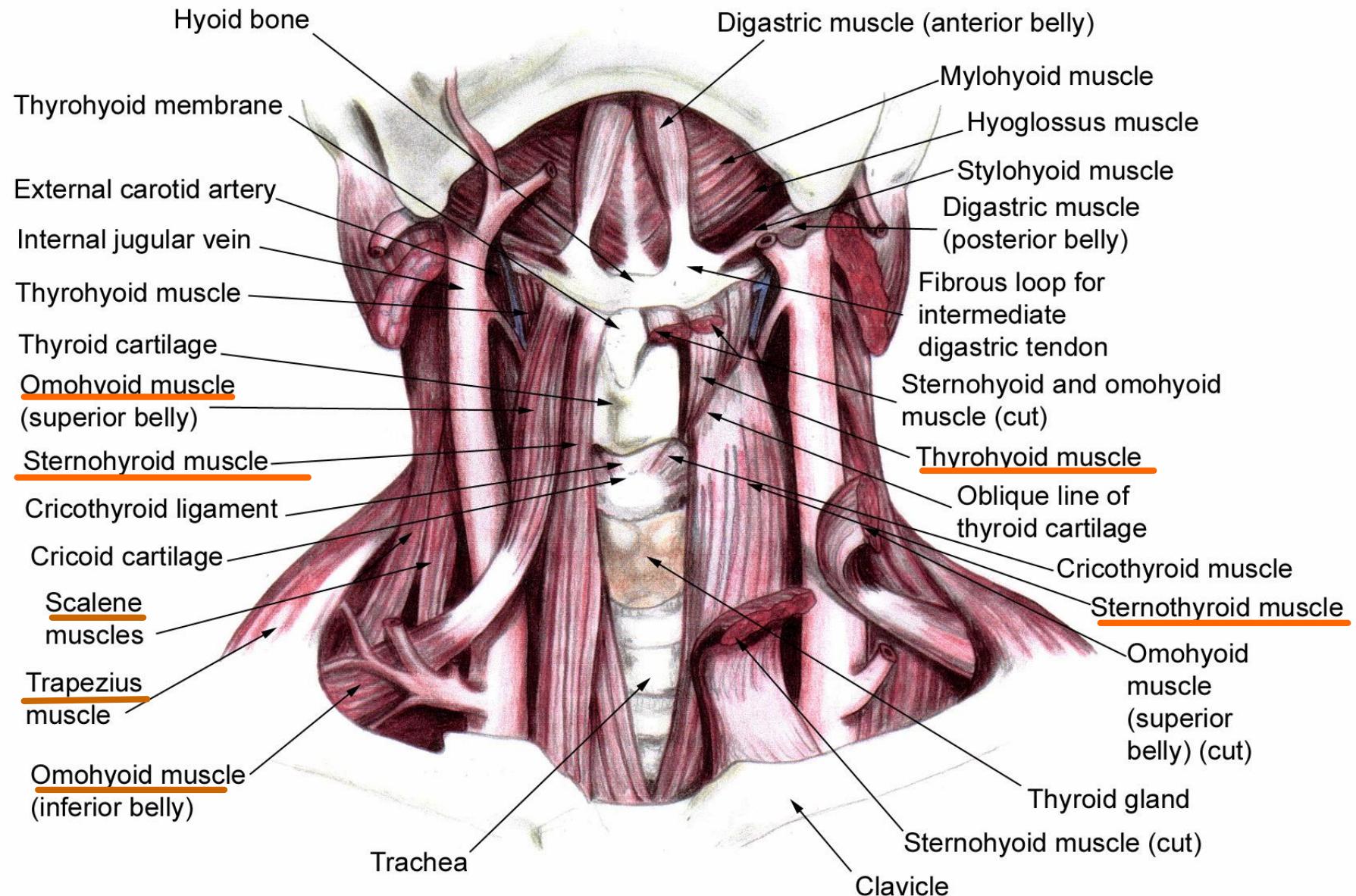


Cervical Plexus (cont)

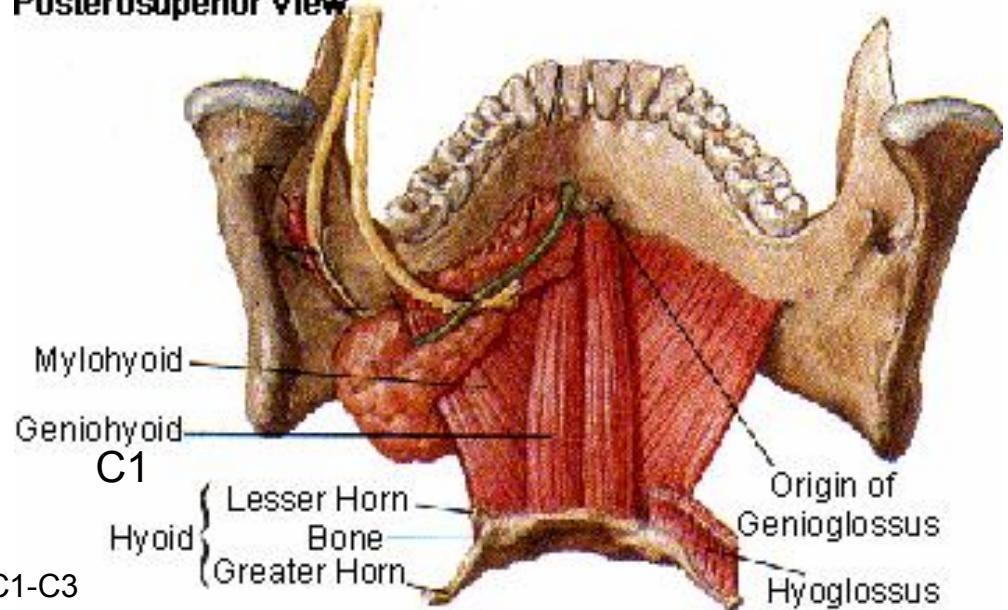
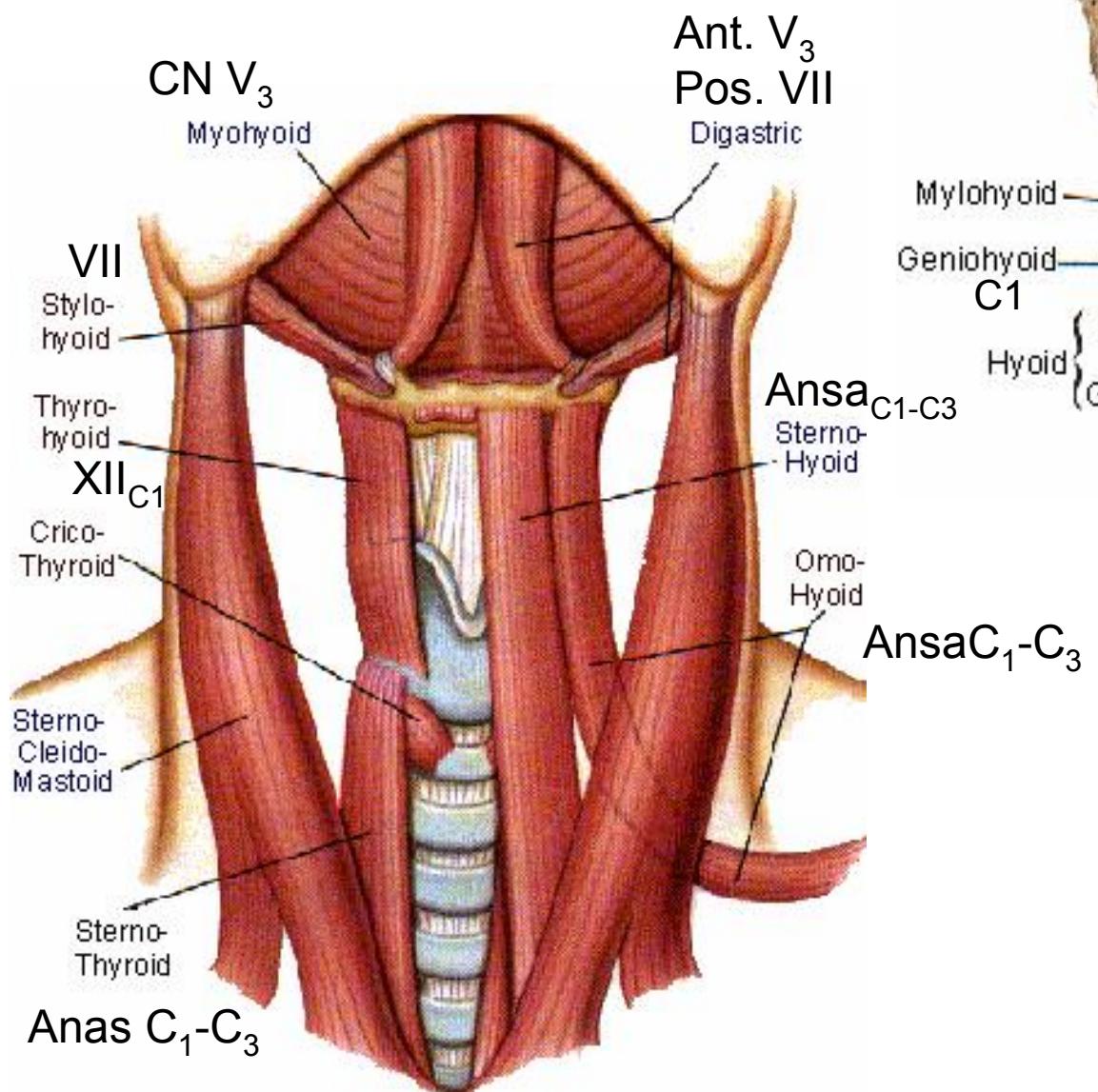
Muscular innervation (cont)

- Fibres from C1 are transported by the hypoglossal nerve to
 - **thyrohyoid** and **geniohyoid**
 - forms the superior root of the **ansa cervicalis** with the ansa cervicalis inferior root (derived from C2 & C3)
 - **infrahyoid muscles**
 - omohyoid
 - sternohyoid
 - sternothyroid
 - thyrohyoid
 - geniohyoid





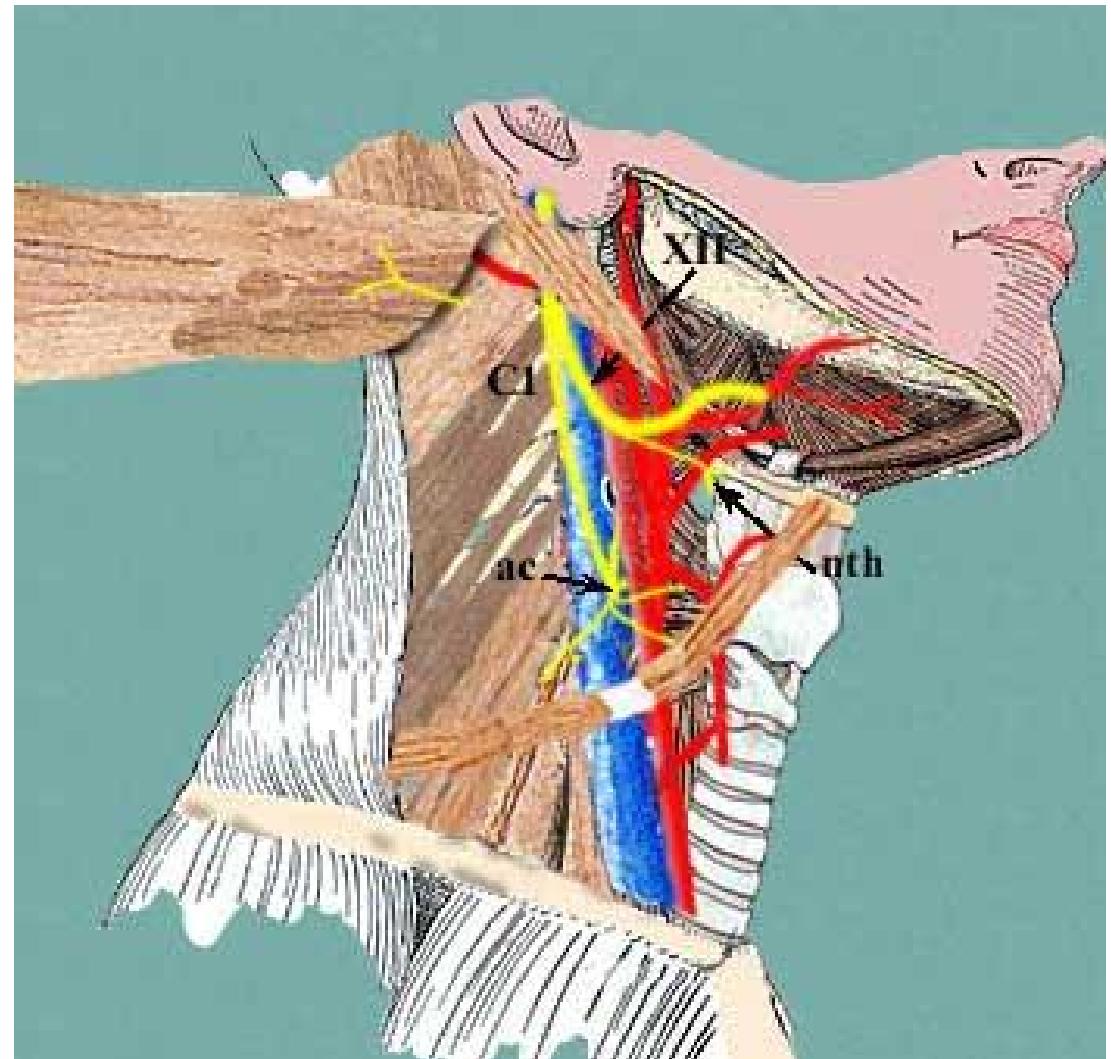
Posterosuperior View



Ansa Cervcalis & Hypglossal

The nerves that enter the carotid triangle and that lie superficial to the internal jugular vein, internal and external carotid arteries are:

- hypoglossal (XII)
- C1 root of ansa cervicalis (C1)
- C1 fibers running with hypoglossal nerve (nerve to thyrohyoid muscle (nth))
- C2-C3 root of ansa cervicalis
- ansa cervicalis (ac)



CN XII

Genioglossus
Hyoglossus
Styloglossus
Geniohyoid C1
Thyrohyoid C1

CN VII

Buccinator
Digastric pos.
Stylohyoid

CN V

Digastric Ant. V3
Mylohyoid V3

Ansa C1-C3

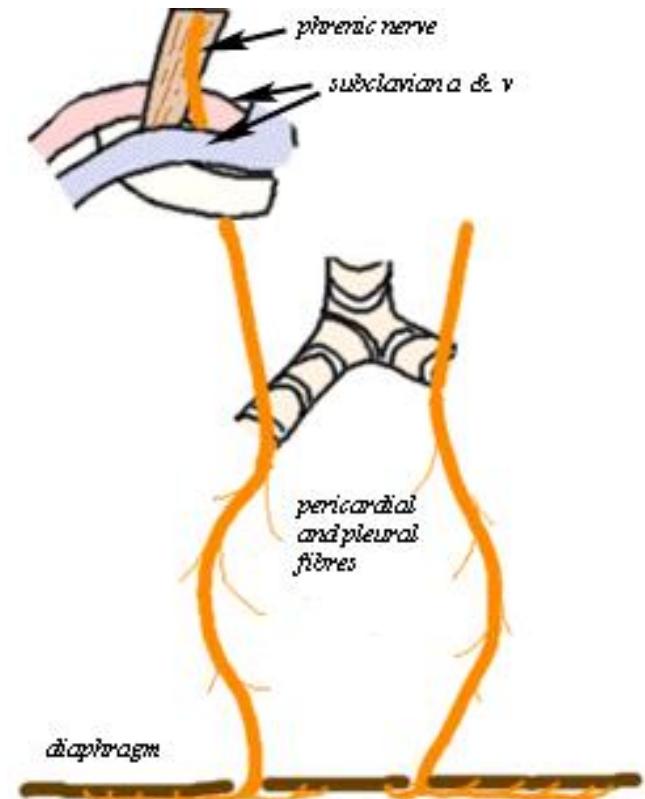
Sternohyoid
Sternothyroid
Omohyoid

Muscular innervation

sternocleidomastoid (C2 & C3)
levator scapulae (C3 & C4)
trapezius (C3 & C4)
portions of scalenes

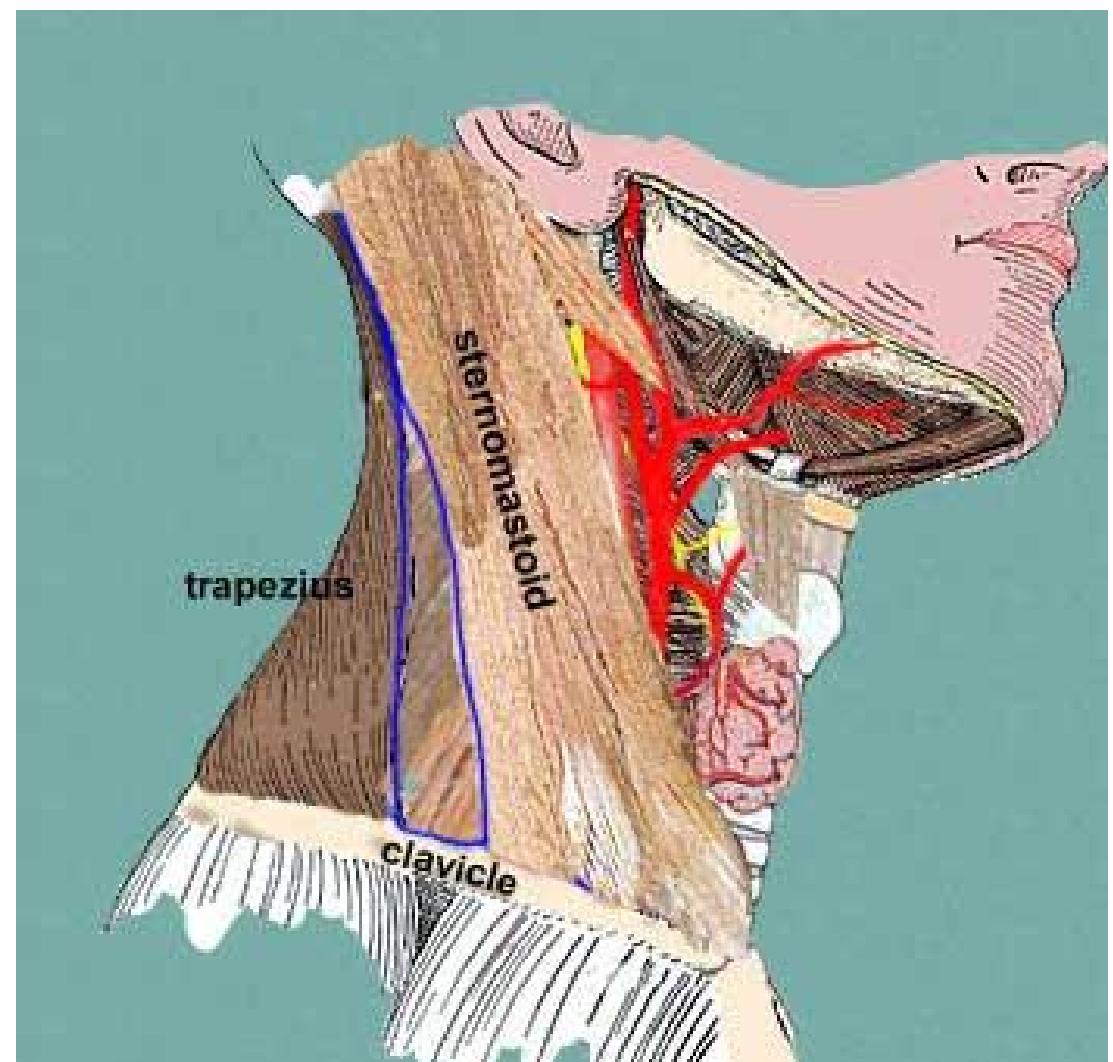
Cervical Plexus (cont)

- **Phrenic Nerve** (C3 & C4 & C5) - Descends through the neck and thorax to **supply the diaphragm**.
- It lies on the scalenus anterior muscle and enters the thorax between the subclavian artery and the subclavian vein.
- The phrenic nerve is the **only nerve to the diaphragm**



Brachial Plexus Emerges From The Posterior Triangle

- **Posterior triangle-- bordered by the posterior border of the SCM, trapezius, and clavicle**

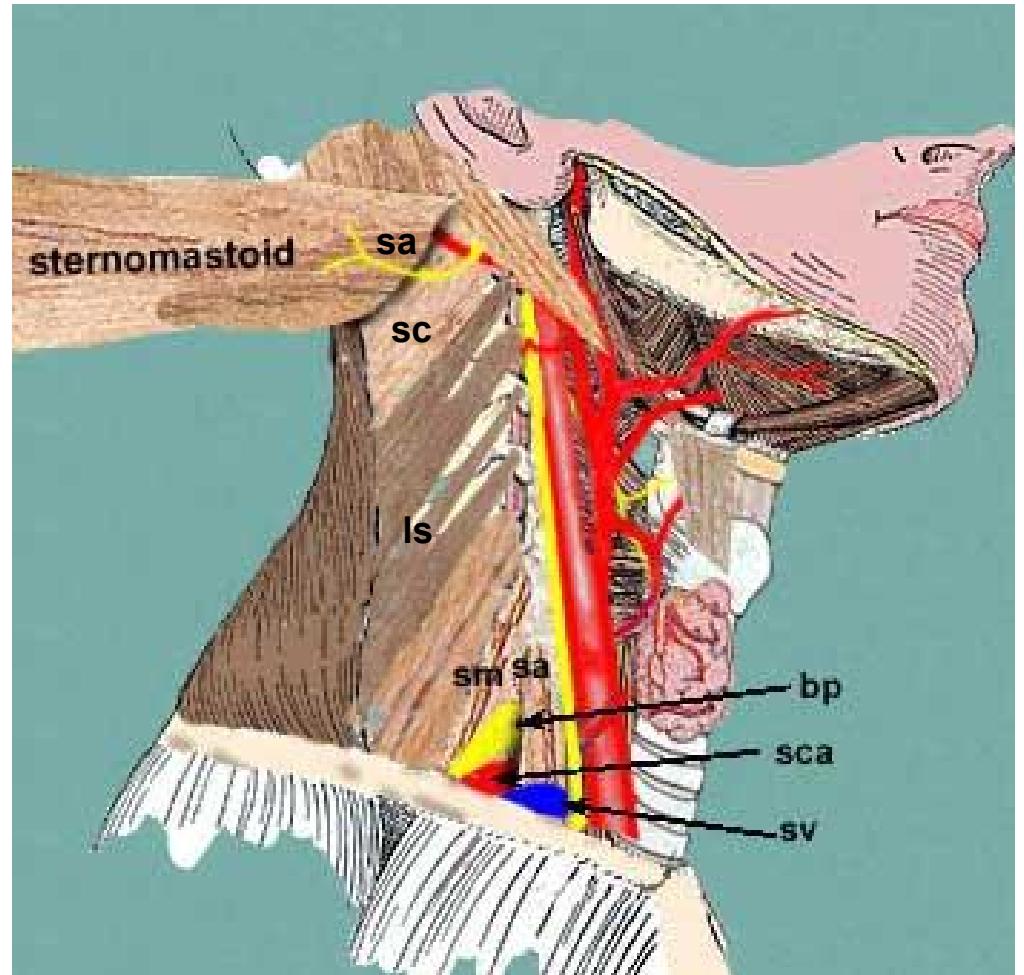


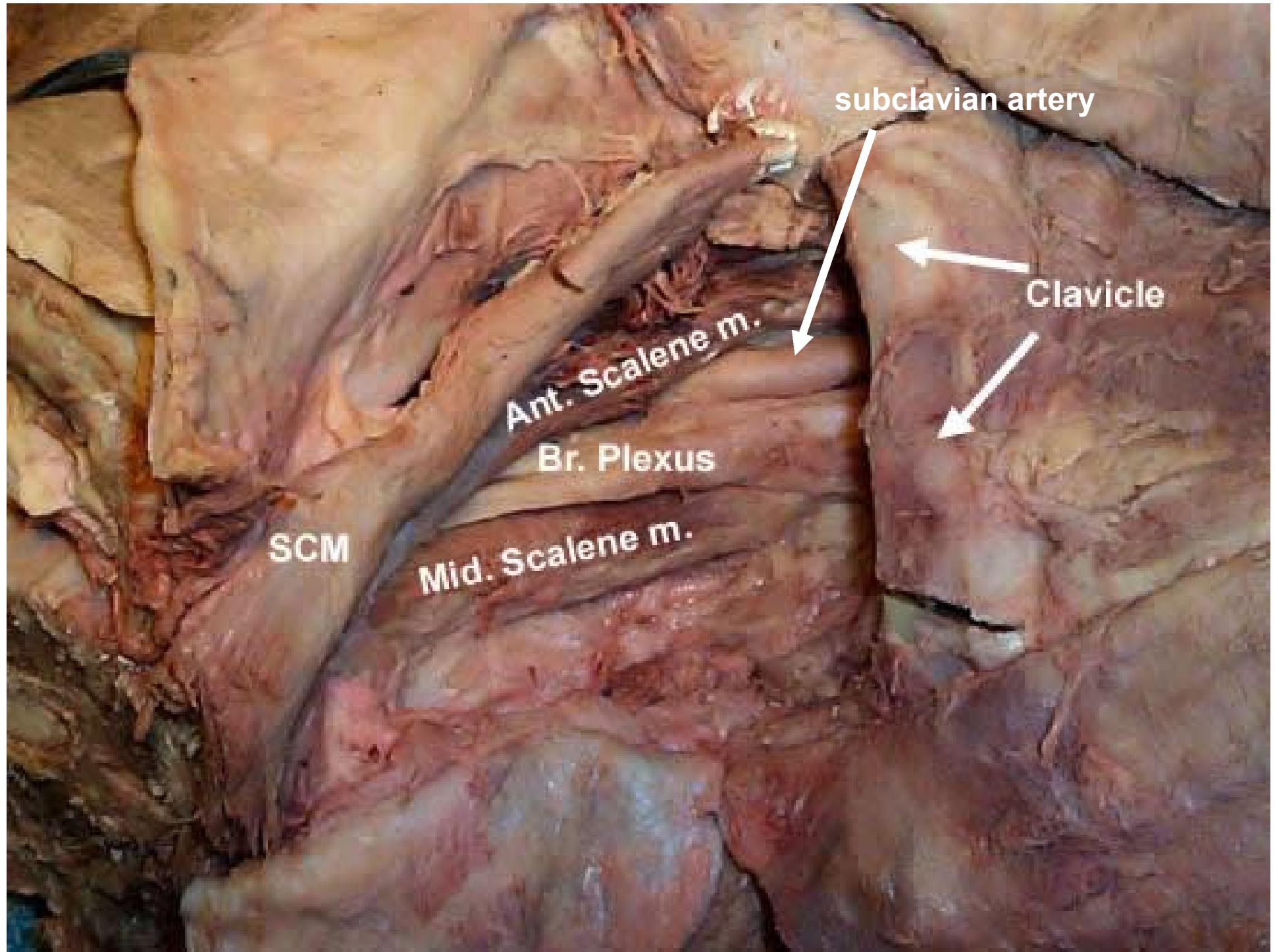
Brachial Plexus

- the **brachial plexus** and subclavian artery pass between the **scalenus anterior (sa) and medius (sm) muscles**. The subclavian vein passes anterior to the scalenus anterior muscle.

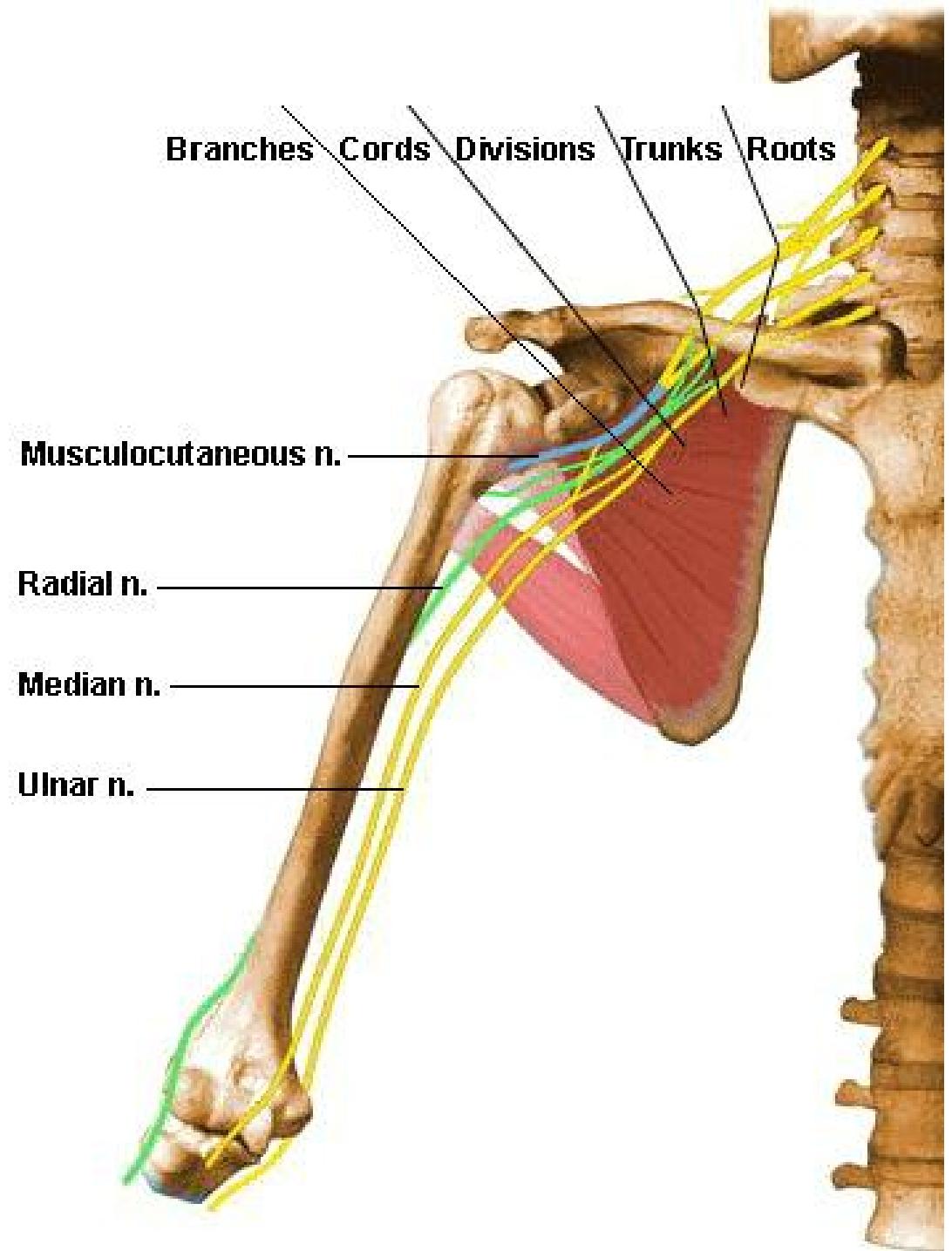
Legend

brachial plexus (bp)
subclavian artery (sca)
subclavian vein (sv)
scalenus anterior (sa)
medius (sm) muscles
levator scapulae (ls)
spinal accessory (sa) nerve





- **roots**- formed by the 5 ventral rami (C5-T1)
- five roots unite to form the **upper, middle, and lower trunks**
- Each trunk divide into an **anterior and posterior division**
- the six divisions merge to form three large fiber bundles, the **medial, posterior, and lateral cords** (according to its position in relation to the axillary artery)
- cords form 5 major **branches**
 - **axillary**
 - **radial**
 - **musculocutaneous**
 - **median**
 - **ulnar**



The Brachial Plexus

The posterior nerves

The posterior cord,

Axillary nerve

Radial nerve

superior or upper
trunk

middle
trunk

Roots

C5

C6

C7

C8

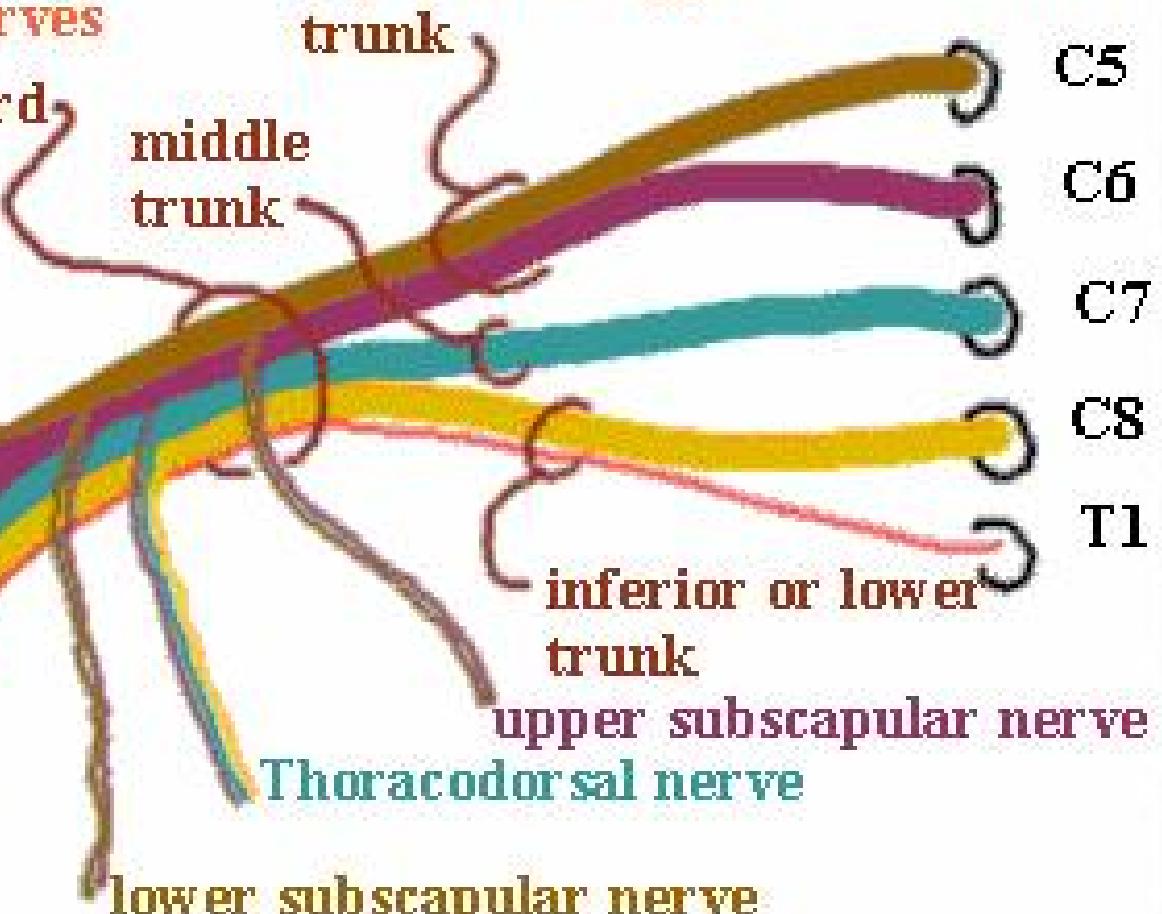
T1

inferior or lower
trunk

upper subscapular nerve

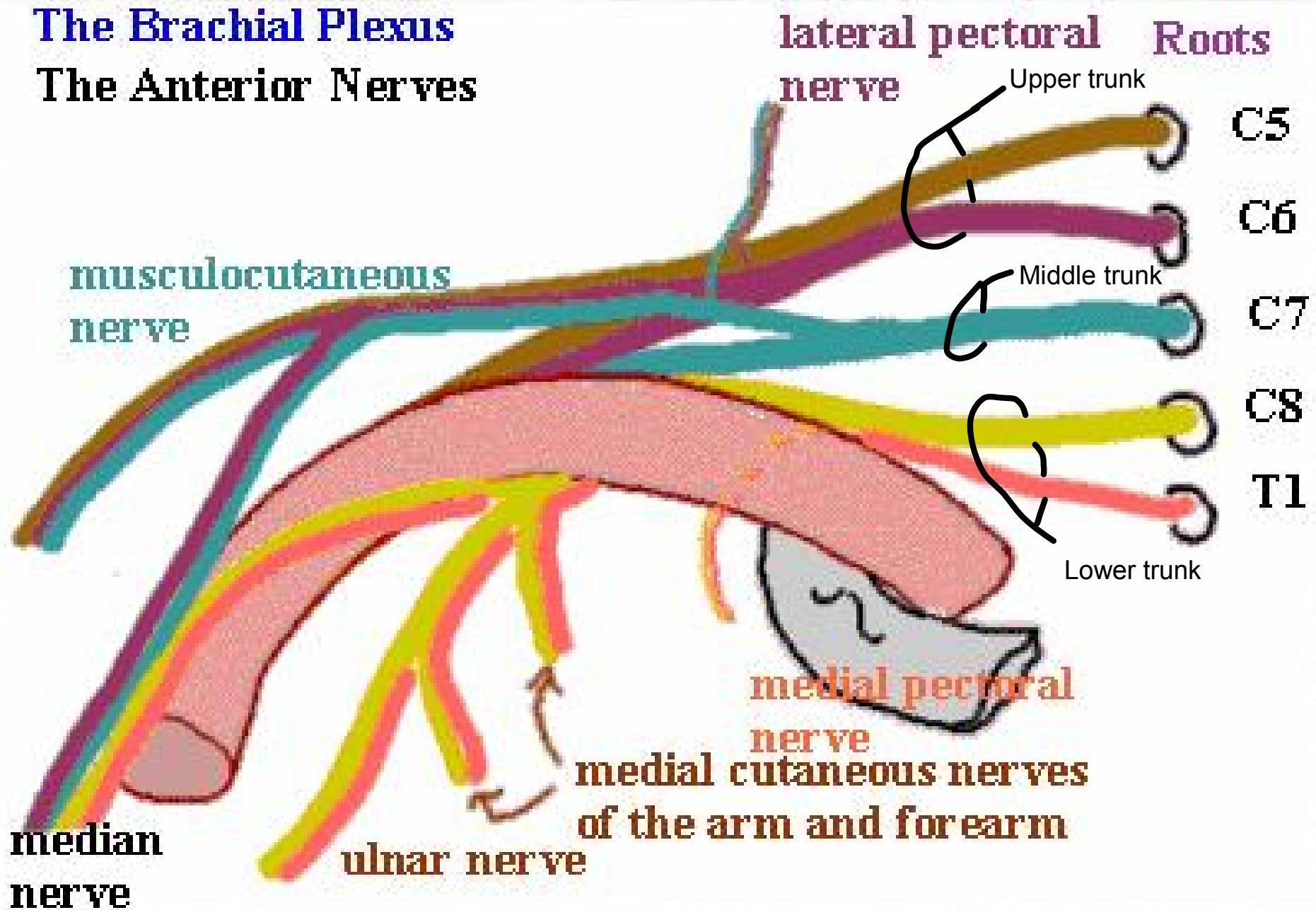
Thoracodorsal nerve

lower subscapular nerve



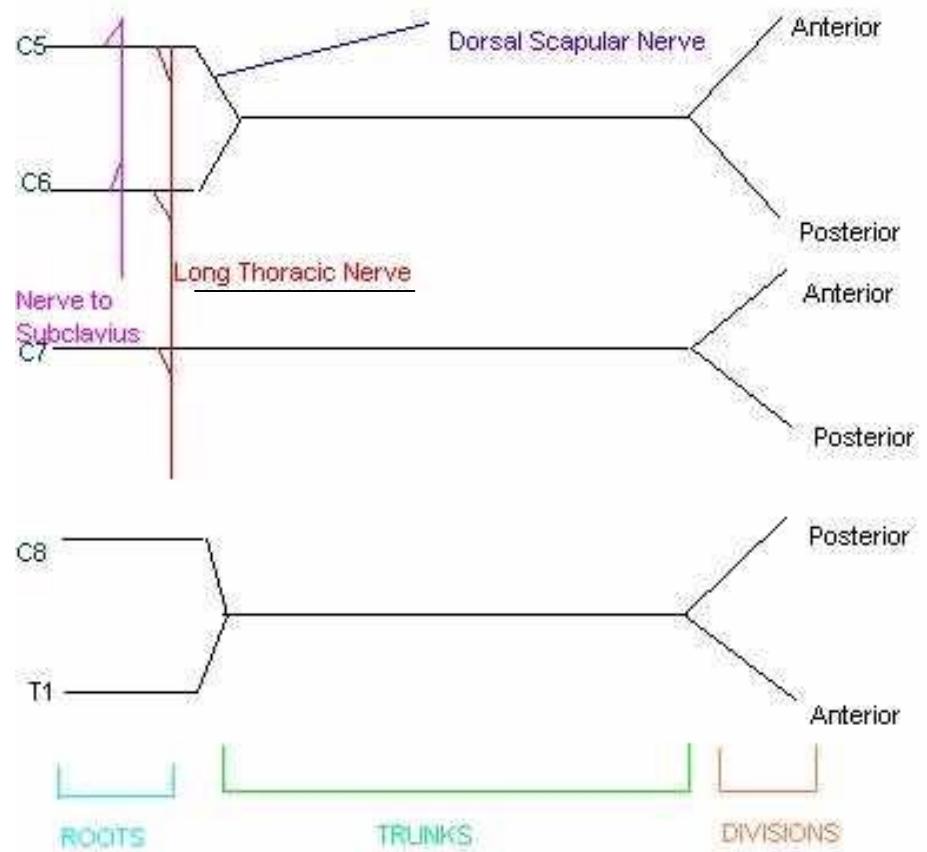
The Brachial Plexus

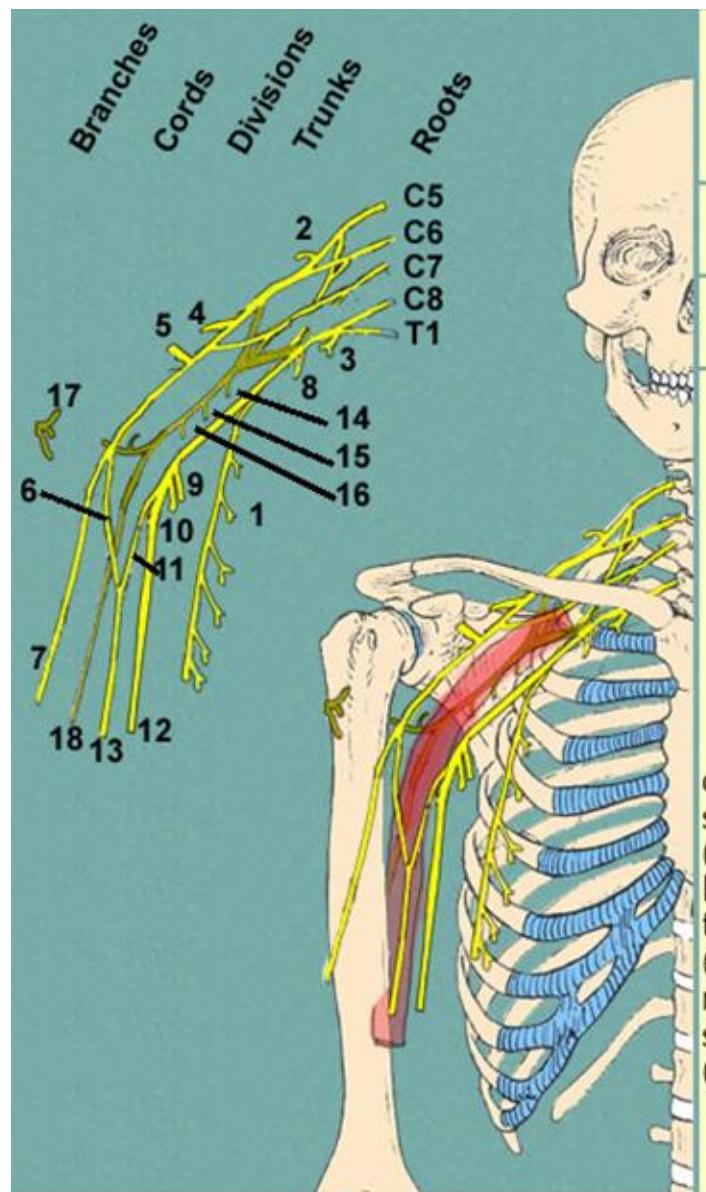
The Anterior Nerves



Brachial plexus

- origin in the posterior triangle of the neck. ■
- they enter the posterior triangle by emerging from between the interval between scalenus anterior and scalenus medius. ■
- formed from the ventral rami of C5, C6, C7, C8, and T1
- Along with the subclavian artery, the brachial plexus acquires a sheath, the axillary sheath. ■





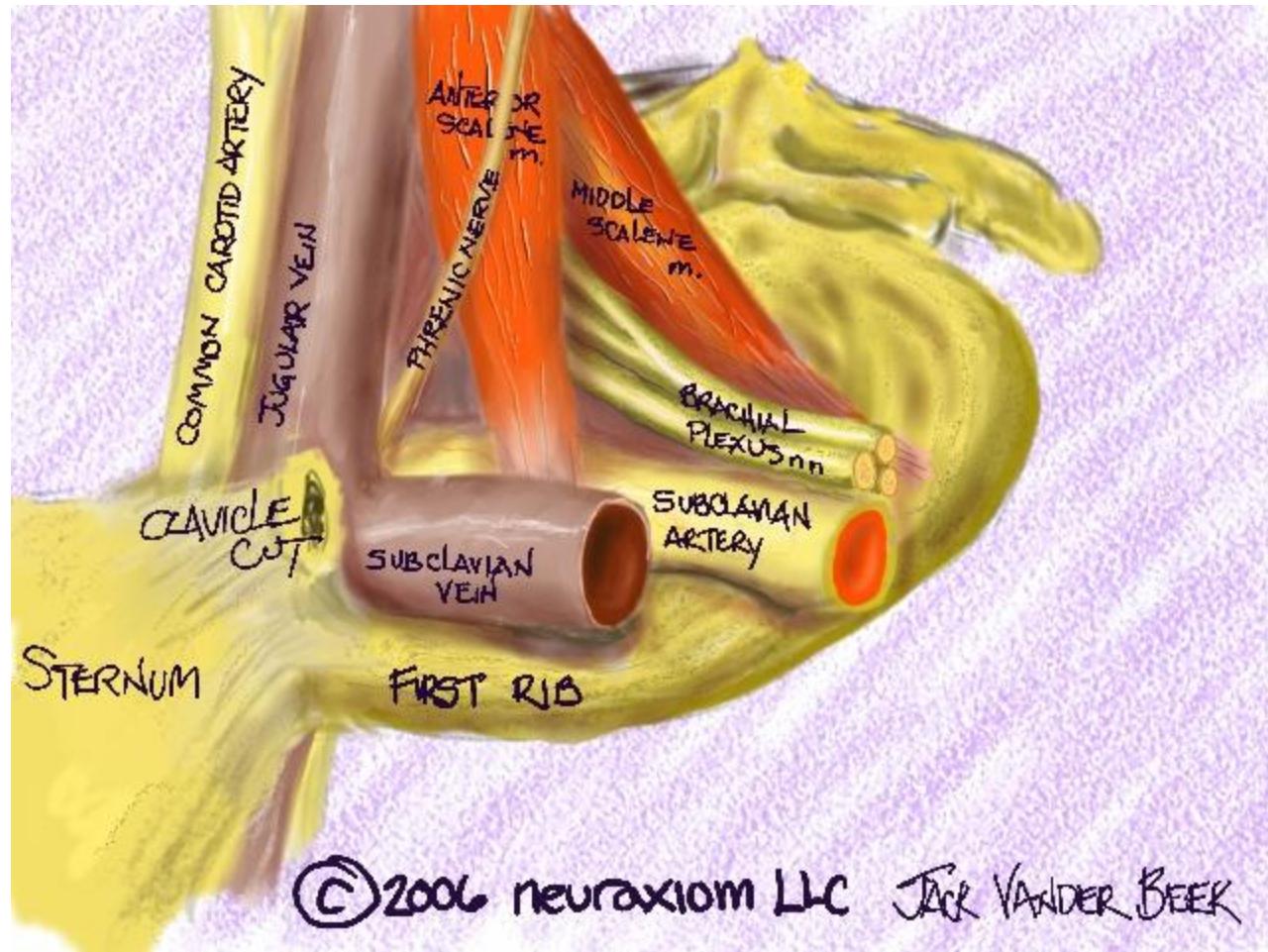
Branches of Brachial Plexus

Roots	Trunks	Cords		
		Lateral	Medial	Posterior
dorsal scapular (2) long thoracic (1) nerve to subclavius (3)	suprascapular (4)	lateral pectoral (5) lateral head of median n. (6) musculocutaneous (7)	medial pectoral (8) medial cutaneous of arm (9) medial cutaneous of forearm (10) medial head of median n. (11) ulnar (12)	upper subscapular (14) thoracodorsal (15) lower subscapular axillary (17) radial (18)

- Dorsal scapular
 - Long thoracic
 - Nerve to subclavius
 - Suprascapular
 - Lateral pectoral
 - Medial pectoral
 - Upper subscapular
 - Thoracodorsal
 - Lower subscapular
 - Axillary
- Musculocutaneous
 - Radial
 - Median
 - Ulnar

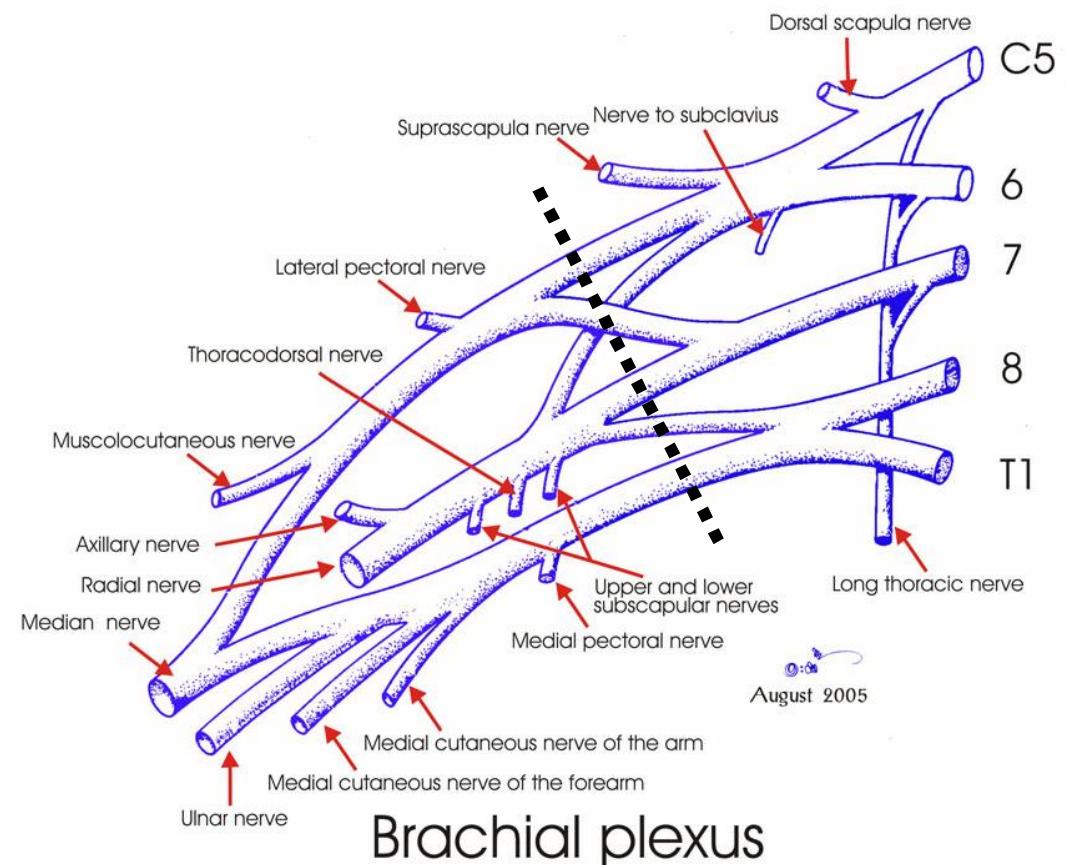
The Brachial Plexus

- It is situated partly in the neck and partly in the axilla.
- The **supraclavicular part** (rami and trunks with their branches) of the brachial plexus is in the posterior triangle of the neck,
- Its **infraclavicular part** (cords and their branches) is in the axilla.



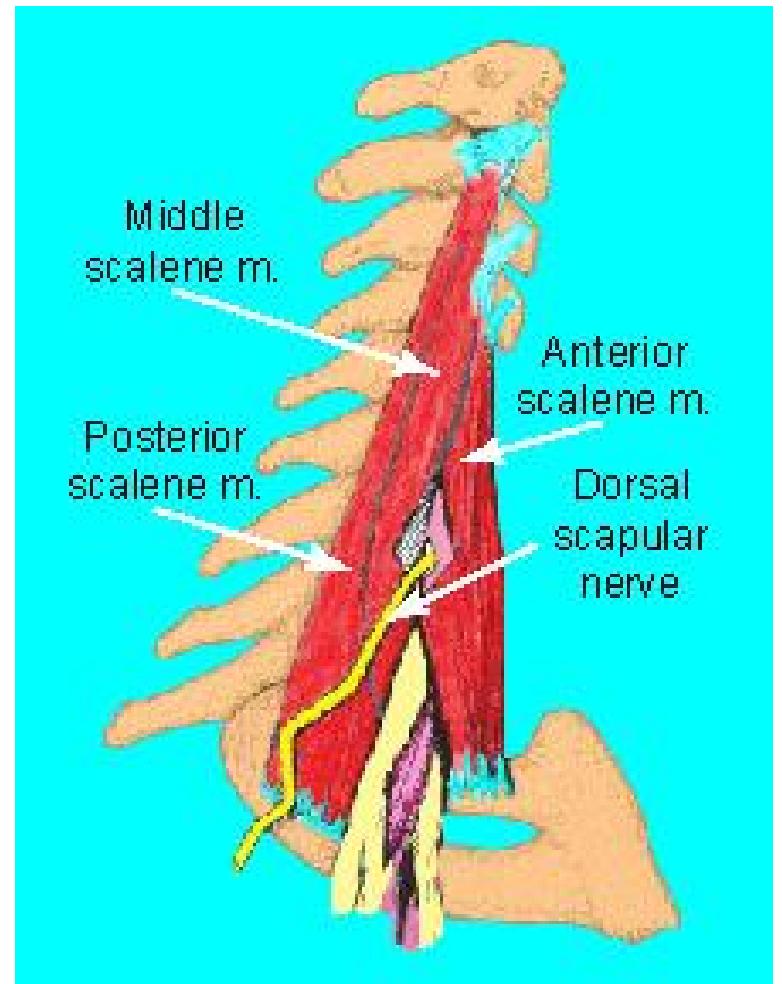
Suprascapular Branches of the Brachial Plexus

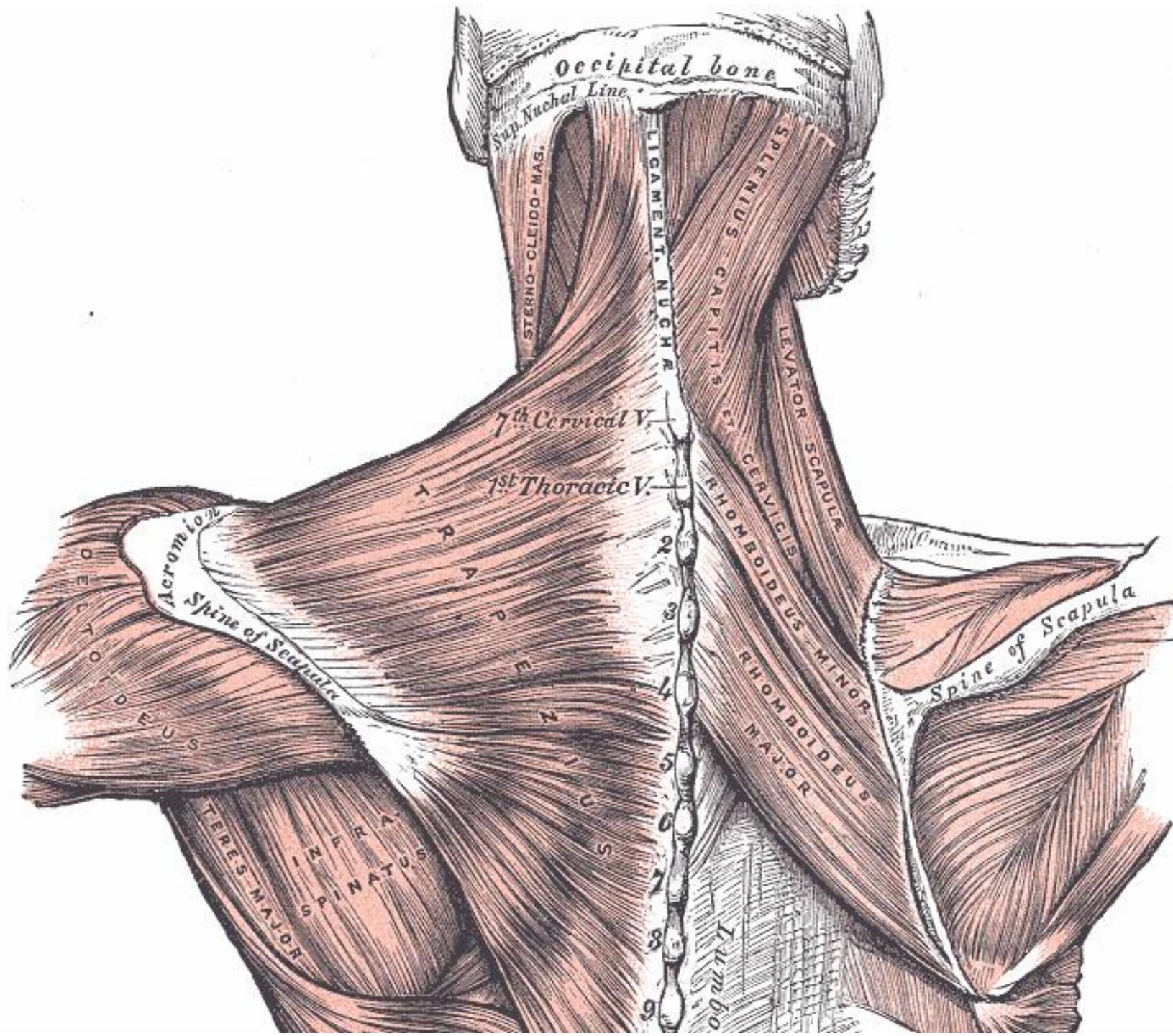
- The Dorsal Scapular Nerve
- The Long Thoracic Nerve
- The nerve to the Subclavius Muscle
- The Suprascapular Nerve



Dorsal Scapular Nerve

- arises predominately from the 5th cervical nerve and may receive contribution from C4 and C6.
- The nerve is **purely motor**, with no sensory fibers.
- It enters the interscalene triangle and almost immediately
 - pierces the **scalenus medius muscle**, running dorsally and caudally to
 - supply the **rhomboid major and minor muscles** and a
 - portion of the **levator scapula**. The levator scapula receives additional nerve supply from the 3rd and 4th cervical nerves.





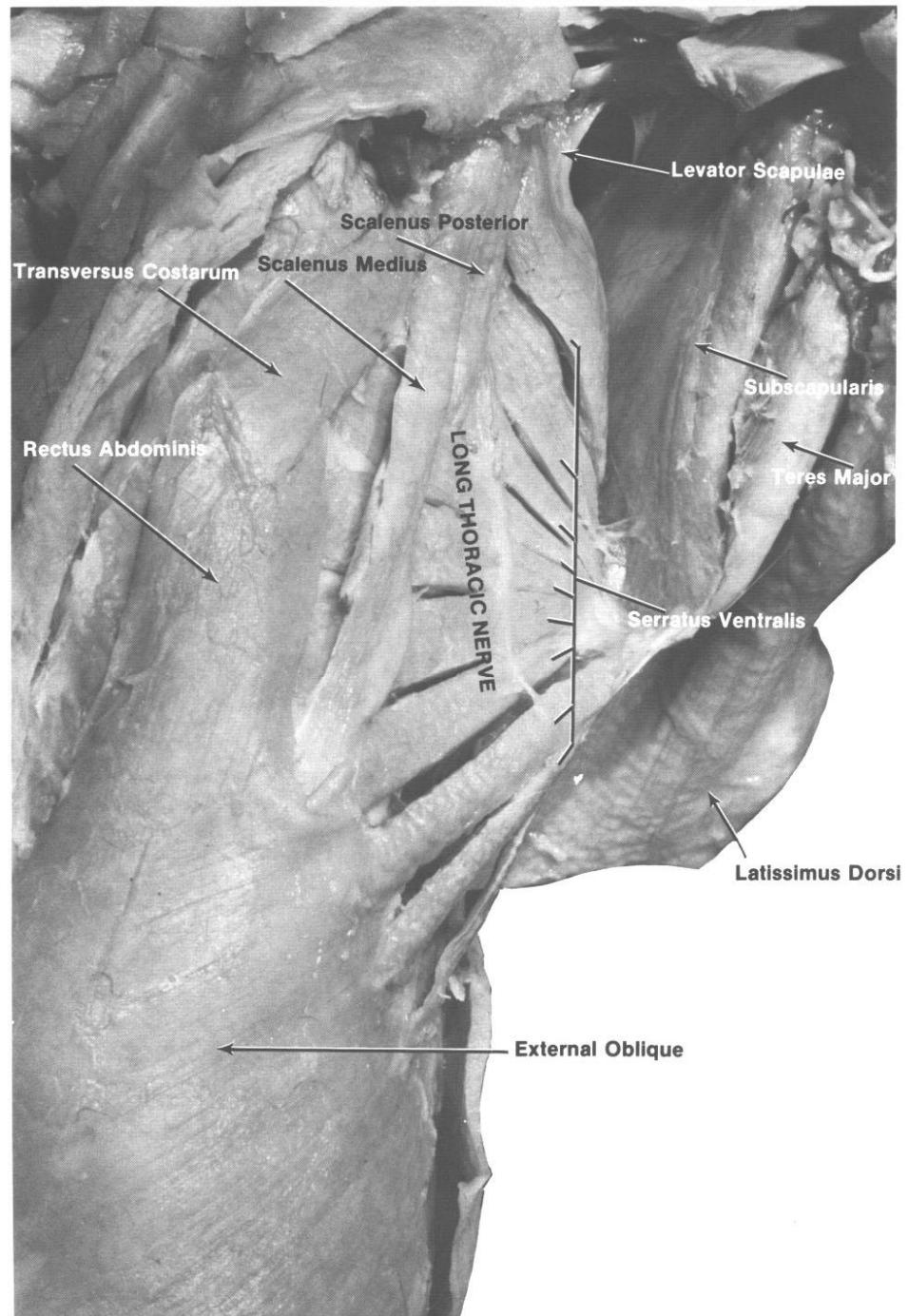


Long Thoracic Nerve

Nerve Origin: Direct branch from C5, C6, C7 roots

Muscles Innervated: **Serratus Anterior**

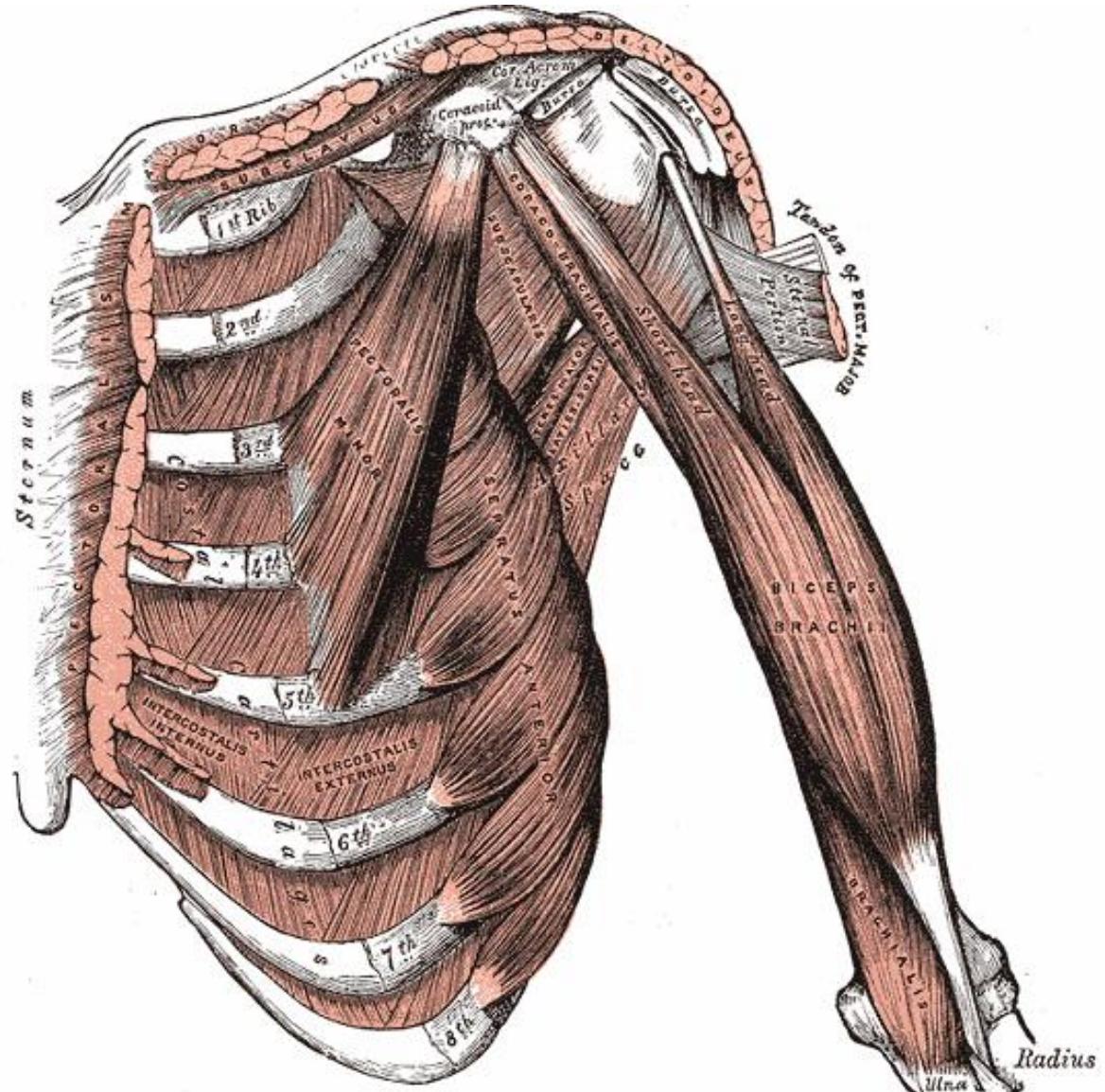
- This is formed from the posterior aspect of the ventral rami of **C5, C6 C7**.
- It passes through the apex of the axilla posterior to the other components of the brachial plexus.
- It supplies the serratus anterior muscle.
- The roots of C5 and C6 pierce the scalenus anterior muscle and the root of C7 passes anterior to this muscle.



DEEP MUSCLES - THORAX AND SHOULDER, VENTRAL VIEW

Nerve to the Subclavius

- This nerve is from the anterior aspect of the **superior trunk**, from **C5**, with occasional additions from C4 and C6.
- It descends posterior to the clavicle and anterior to the brachial plexus to supply the **subclavius muscle**.



Suprascapular Nerve

Nerve Origin: C5, C6 roots arising as a direct branch from the upper trunk

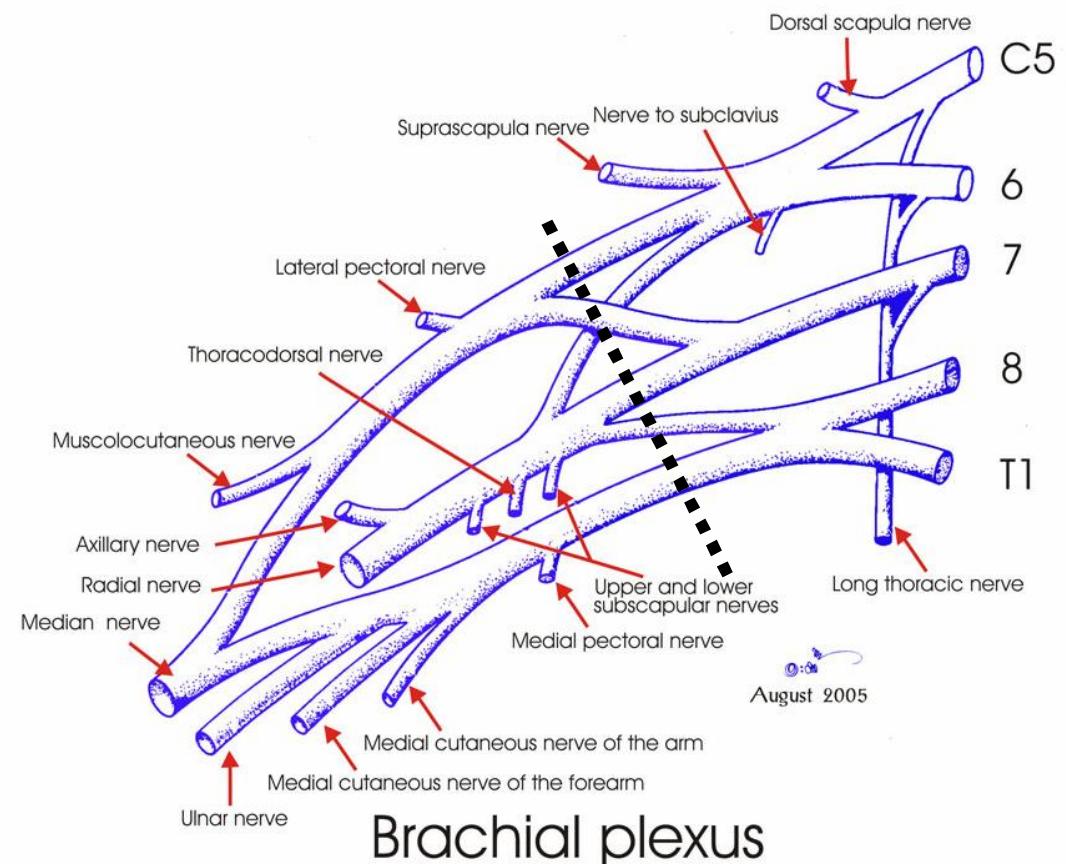
Muscles Innervated:

Supraspinatus Infraspinatus



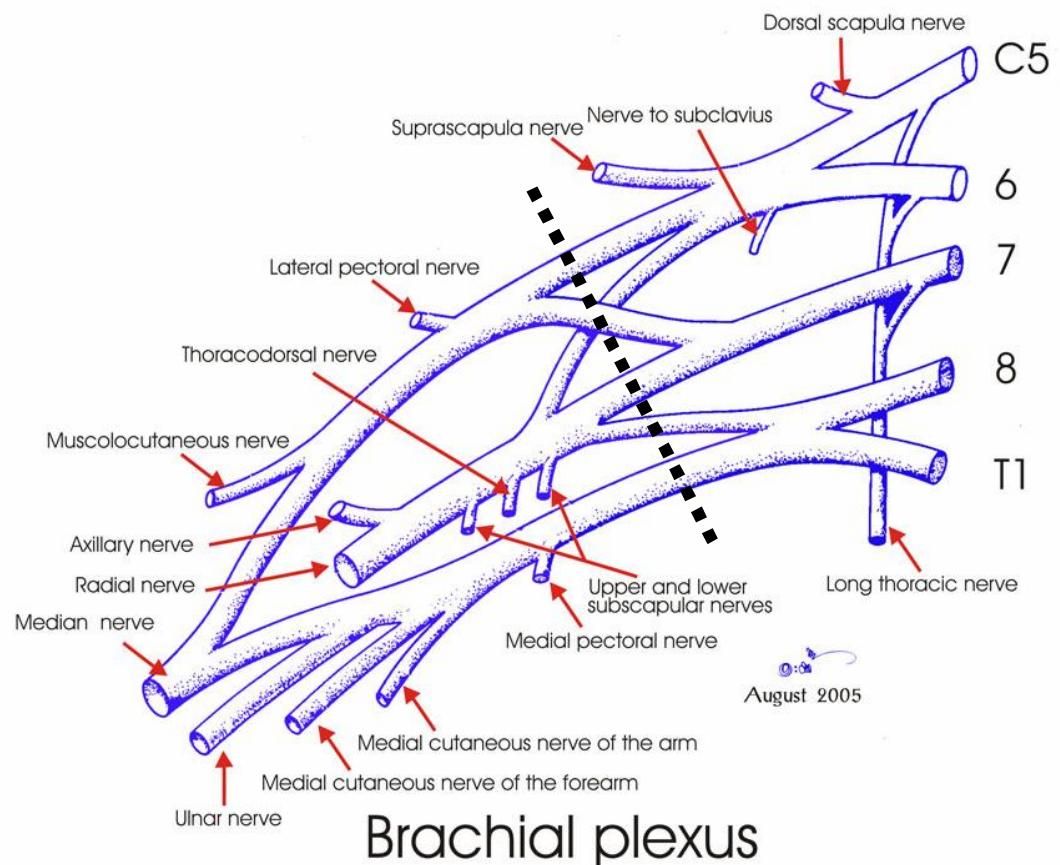
Infraclavicular Branches of the Brachial Plexus

- ***Branches of the Lateral Cord***
- ***Branches of the Medial Cord***
- ***Branches of the Posterior Cord***



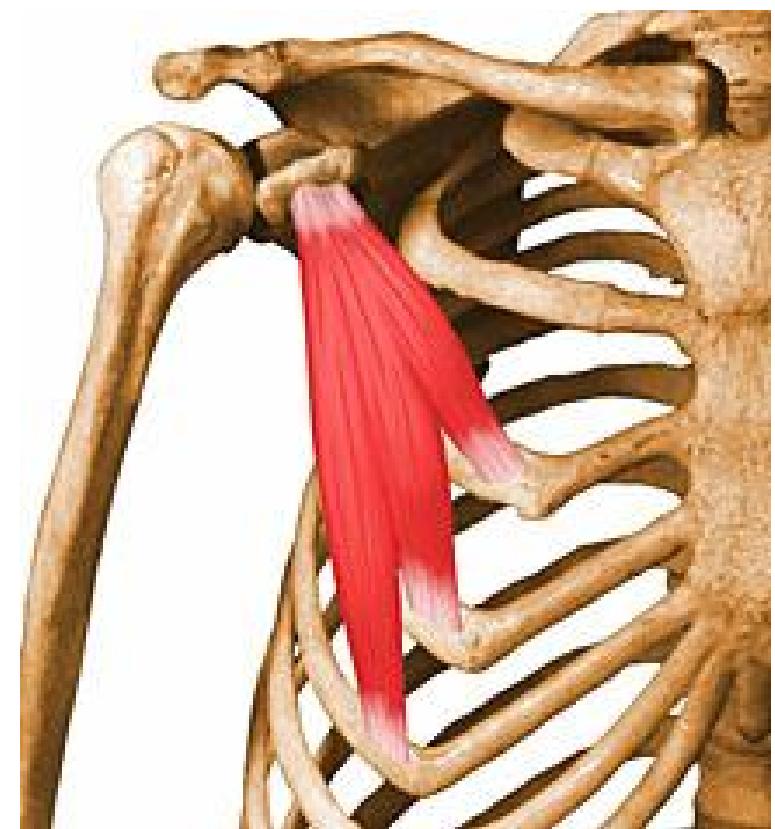
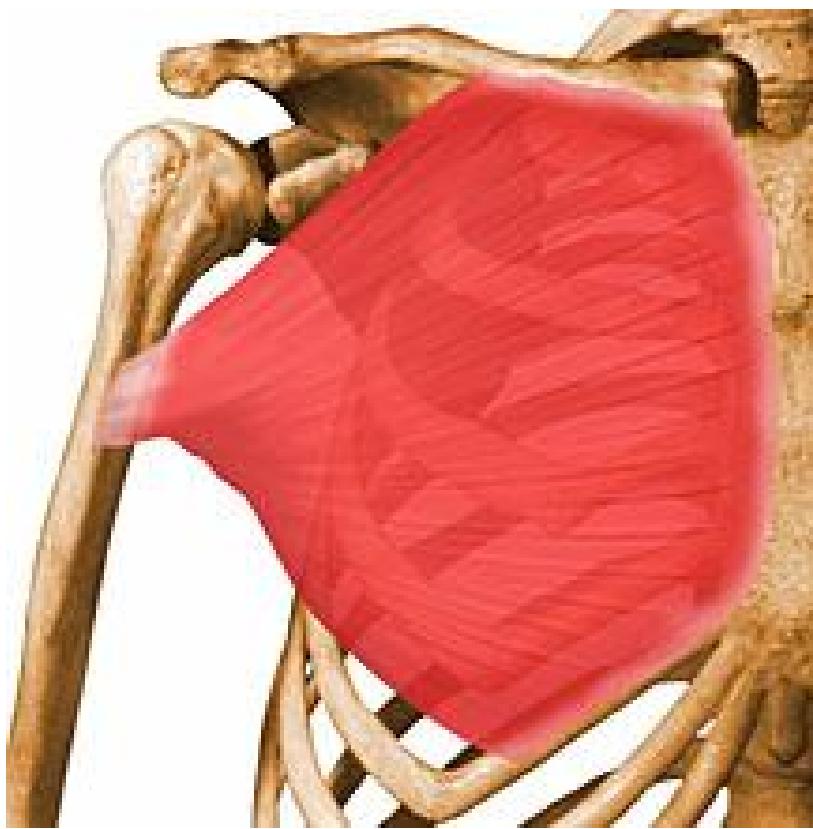
Infraclavicular Branches of the Brachial Plexus

- Branches of the Lateral Cord
 - The lateral cord has **3 branches**;
 - one side branch,
 - **lateral pectoral nerve**
 - two terminal branches,
 - the **musculocutaneous nerve**
 - **lateral root of the median nerve** joined by the medial root of the median nerve to form the median nerve.



The Lateral Pectoral Nerve

- This nerve pierces the **clavipectoral fascia** to supply the **pectoralis major muscle**.
- It also sends a branch to the **medial pectoral nerve**, which supplies the **pectoralis minor muscle**.
- This nerve is so named because it **arises from the lateral cord**; NOT because it is lateral to the medial pectoral nerve.



The Musculocutaneous Nerve

- This nerve **supplies the muscles of the anterior aspect of the arm.**
- It enters deep to the surface of the **coracobrachialis muscle** and supplies it.
- It then continues to supply the **biceps brachii** and the **brachialis muscles**.
- Just proximal to the elbow joint, the musculocutaneous nerve pierces the deep fascia and **becomes superficial**.
- From here it is known as the **lateral antebrachial cutaneous nerve** (lateral cutaneous nerve of the forearm) and it **supplies the skin on the lateral aspect of the forearm.**

Coracobrachialis



Biceps Brachii



Brachialis



Branches of the Medial Cord

- The medial cord of the brachial plexus has **5 branches**; three side branches and two terminal branches.
 - The **Medial Pectoral Nerve**
 - Medial Brachial Cutaneous Nerve
 - The Medial Antebrachial Cutaneous Nerve
 - The **Ulnar Nerve**
 - The **Medial Root of the Median Nerve**

The Medial Pectoral Nerve

- This enters the deep surface of the **pectoralis minor muscle**, and supplies it.
- It also supplies part of the **pectoralis major muscle**.
- This nerve is so named because it **arises from the medial cord**, NOT because it is medial to the lateral pectoral nerve.

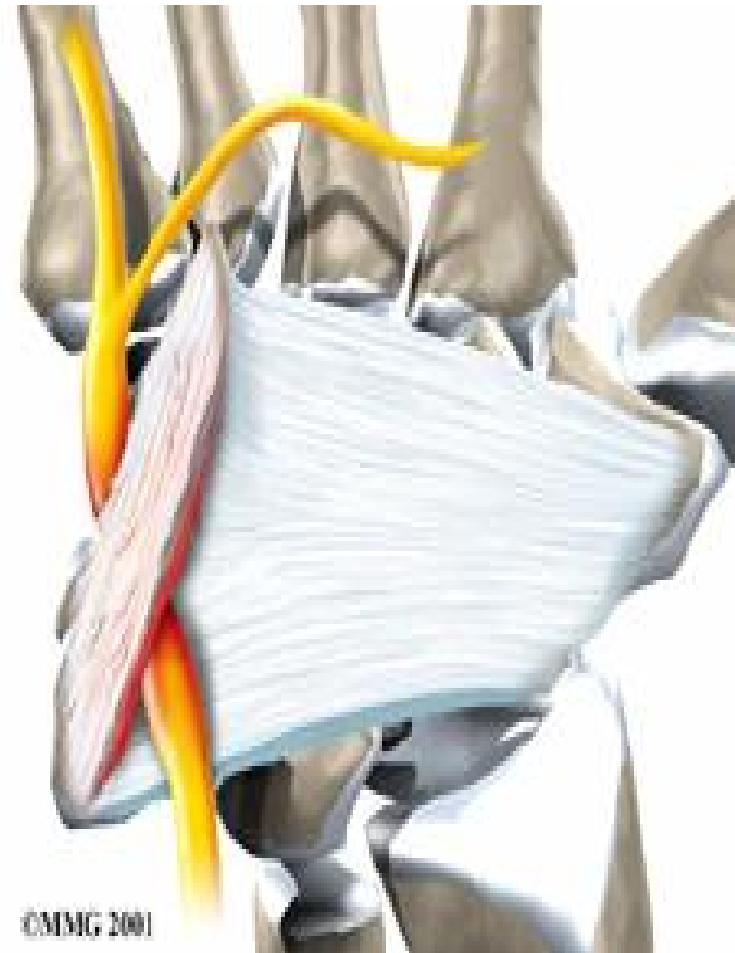
- Medial Brachial Cutaneous Nerve
 - This nerve supplies the **skin over the medial surface of the arm and the proximal part of the forearm.**
 - It usually communicates with the **intercostobrachial nerve**, which supplies the skin of the floor of the axilla and adjacent areas.
- The Medial Antebrachial Cutaneous Nerve
 - This nerve runs between the axillary artery and vein to supply the skin over the **medial surface of the forearm.**

The Ulnar Nerve

- This nerve passes posterior to the **medial epicondyle** of the humerus.
- It enters the forearm by **passing between the two heads** of the **flexor carpi ulnaris muscle**.
- It then **descends deep to this muscle** on the **flexor digitorum profundus**, where it accompanies the ulnar artery near the middle of the forearm.
- Then it passes on the **medial side** of this artery and the **lateral side** of the tendon of **flexor carpi ulnaris**.
- In the distal part of the forearm, the ulnar nerve become relatively superficial covered only by fascia and skin.
- It **pieces the deep fascia** and passes **superficial to the flexor retinaculum** with the ulnar artery, **lateral to the pisiform**, between this bone and the **hook of the hamate**.
- This passage for the nerve and artery, covered with a slip of flexor retinaculum, is referred to clinically as the **canal of Guyon**.

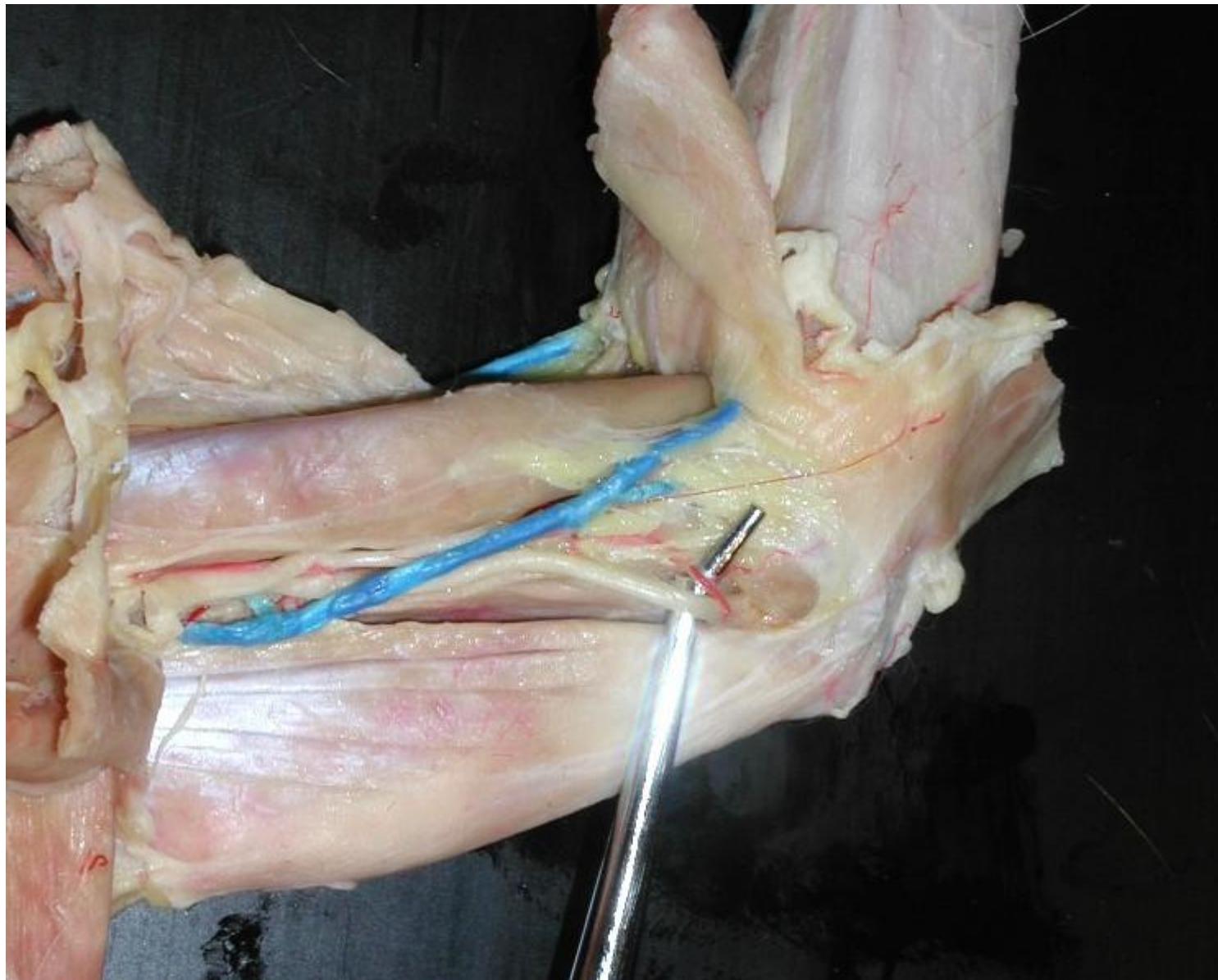
Guyon's Canal Syndrome

- Guyon's canal syndrome is a common nerve compression affecting the ulnar nerve as it passes through a tunnel in the wrist called Guyon's canal. This problem is similar to carpal tunnel syndrome but involves a completely different nerve. Sometimes both conditions can cause a problem in the same hand.



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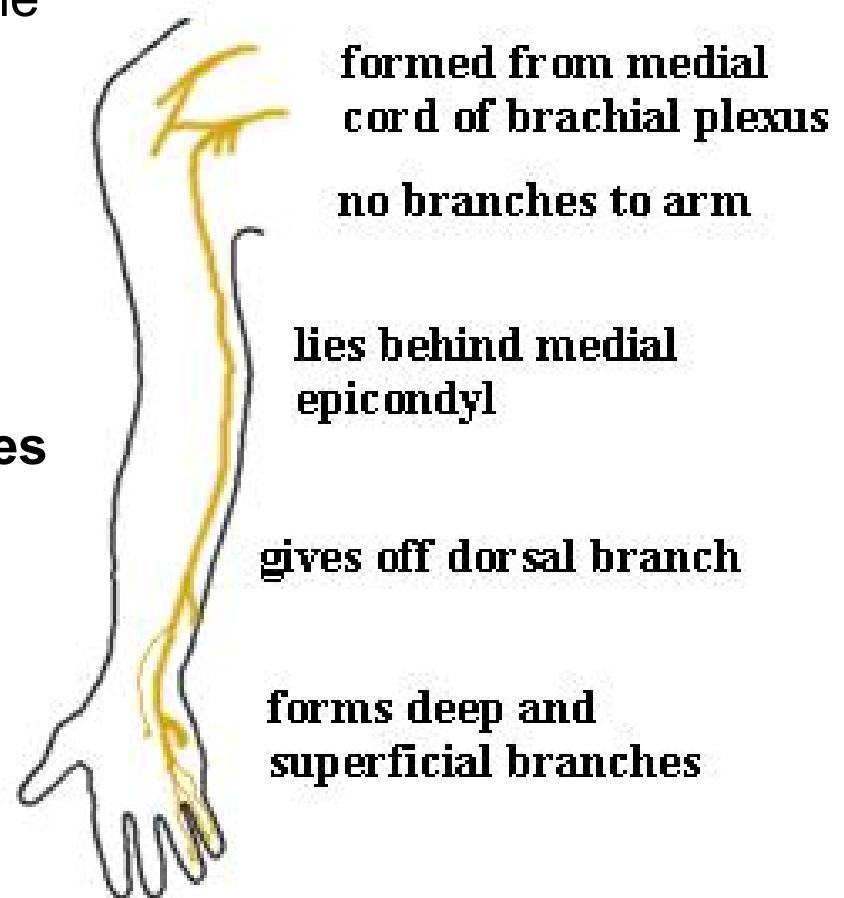
Ulnar nerve



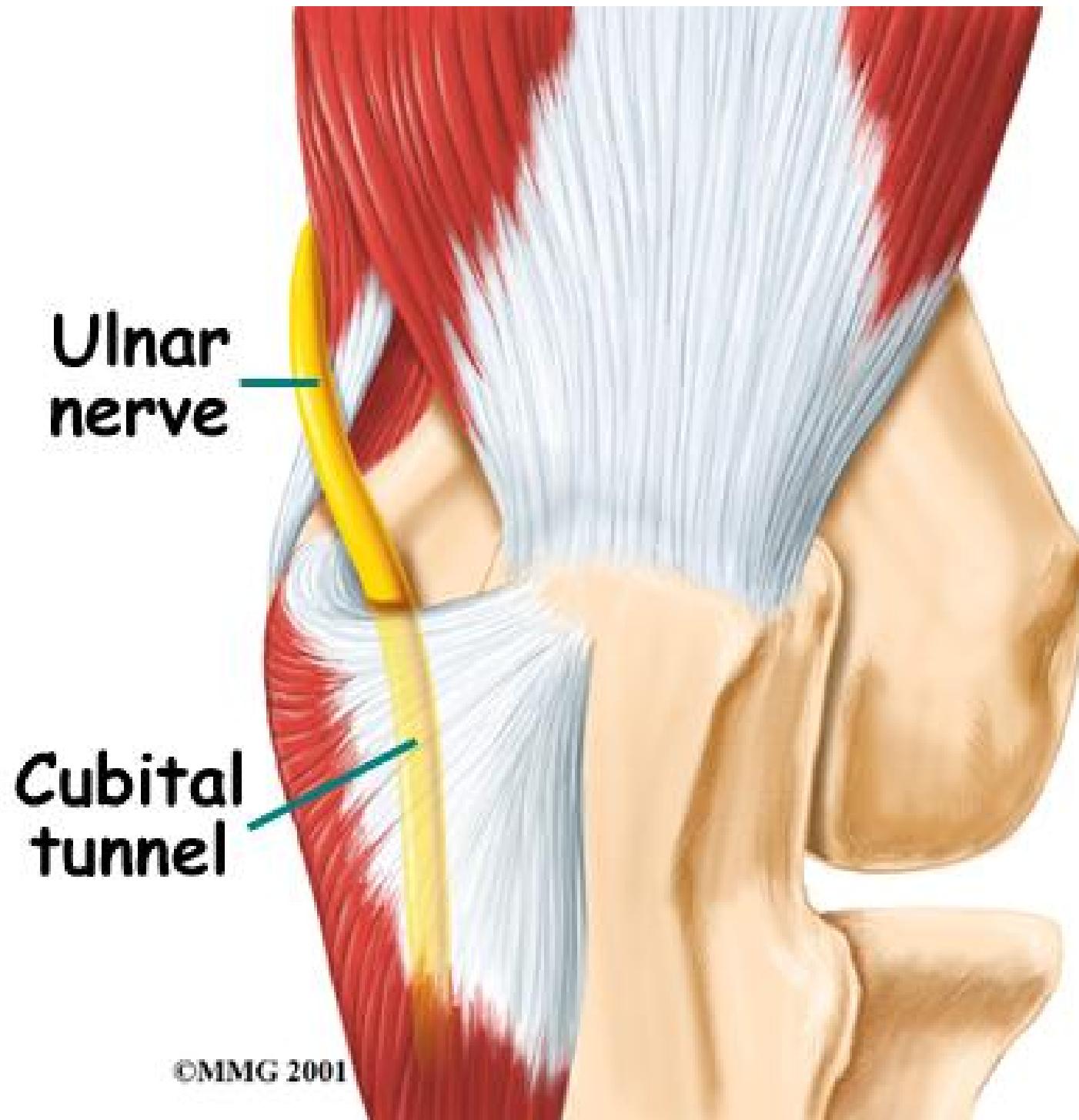


Ulnar Nerve

- formed by fibres from the medial cord.
- half way down the arm, it runs between the medial epicondyle and the olecranon (cubital tunnel).
- It enters the forearm between the two heads of flexor carpi ulnaris. 
- **In the upper forearm the nerve lies between the flexor carpi ulnaris muscles and the flexor digitorum profundus muscles,**



next slide

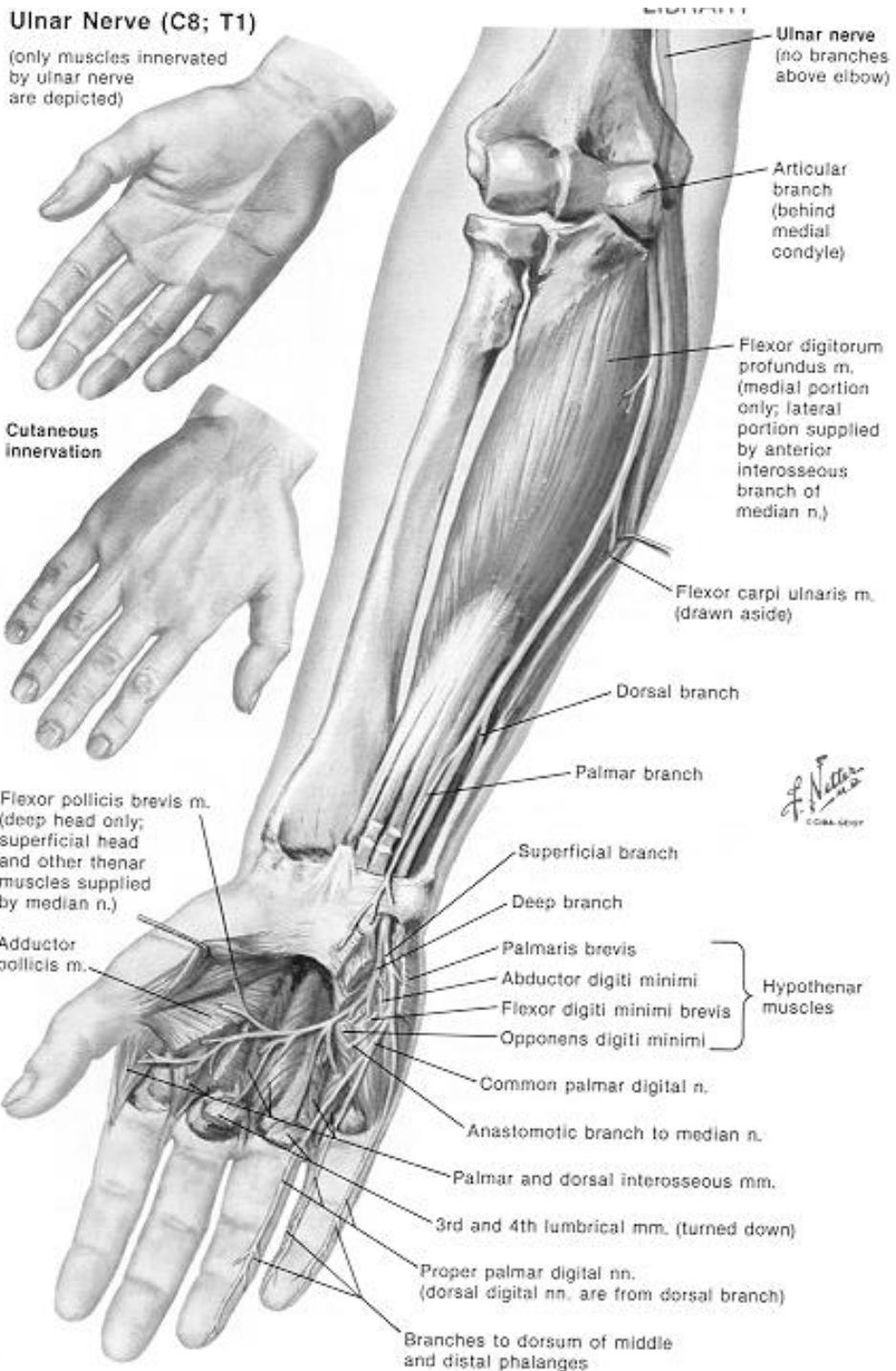


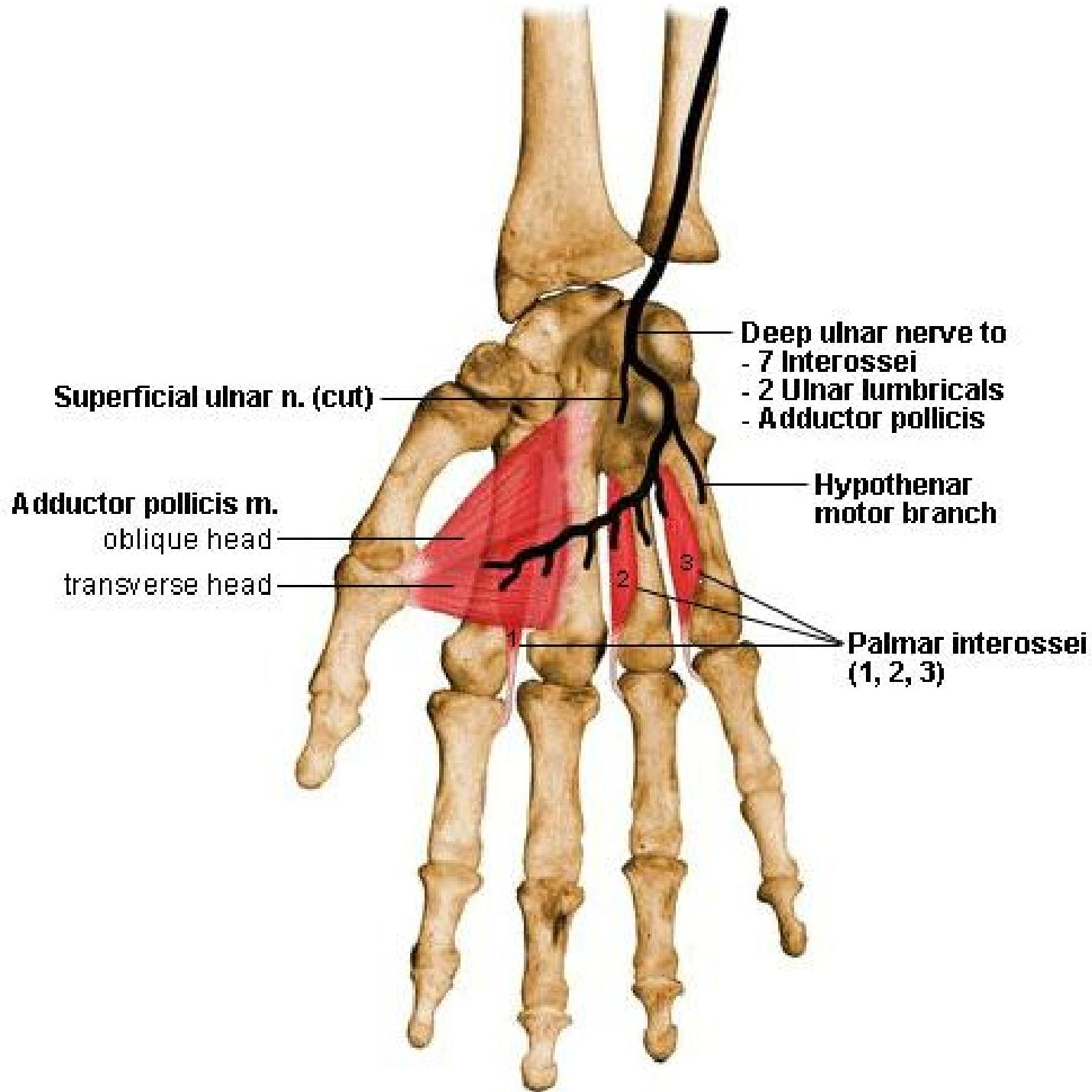
- Above the wrist the nerve gives off a **dorsal branch** which passes backwards to supply the dorsal skin of the medial one and one-half digits, and a small **palmar cutaneous branch** which runs over the flexor retinaculum to supply the medial palm.
- The nerve passes into the hand over the flexor retinaculum together with the artery.
- In the hand it divides into
 - **superficial branch**- supplies **palmaris brevis** and the skin over the palmar surface of the medial one and one-half digits.
 - **deep branches**- pierces between abductor digiti minimi and flexor digiti minimi to reach the deep palm where it supplies the **interossei**, **adductor pollicis**, the **medial lumbricals** and **opponens digiti minimi**

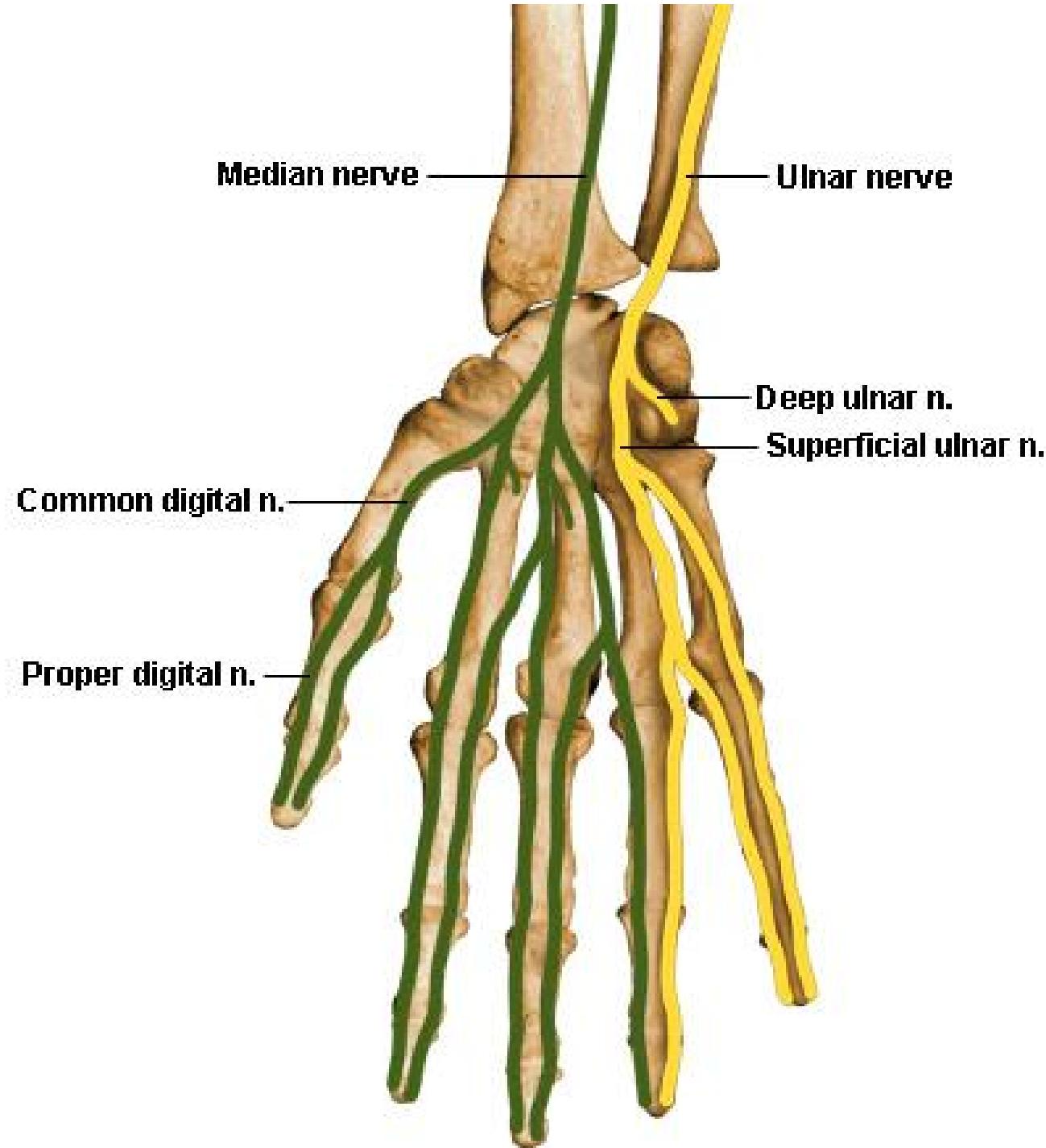
Ulnar Nerve

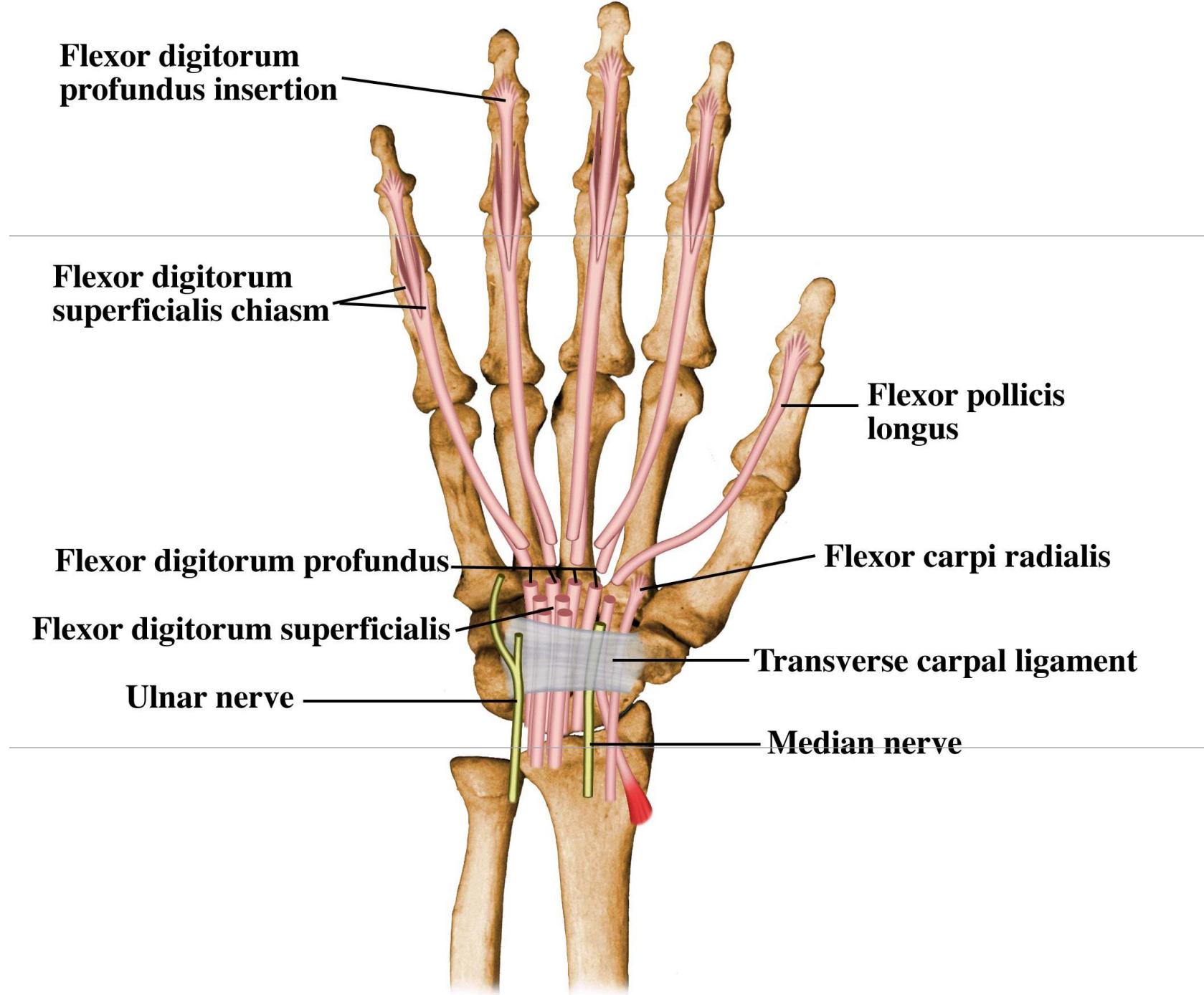


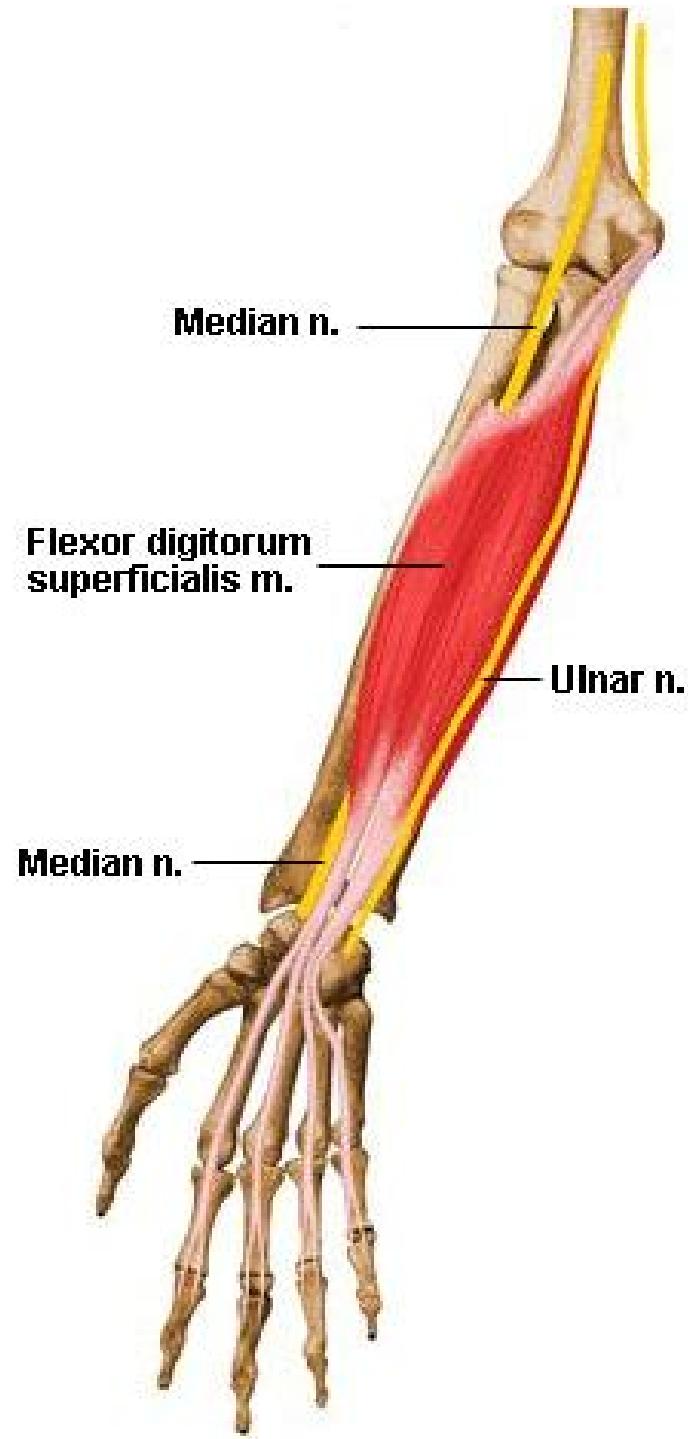
- the ulnar nerve curls around behind the medial humeral epicondyle at the elbow and that its first branches innervate the **flexor carpi ulnaris** and the ulnar half of the **flexor digitorum profundus (4th and 5th fingers)**
- courses down the forearm under the flexor carpi ulnaris muscle and continues to supply innervation to that muscle, but that it **does not innervate any other muscles in the forearm**
- **above the wrist, the ulna nerve gives off a dorsal sensory branch, which courses dorsally across the ulnar styloid to supply sensory innervation to the dorsum of the ulnar one half of the hand**
- in the hand, the main ulna nerve first innervates the **hypotenar muscles** (abductor digiti minimi, flexor digiti minimi brevis and opponens digiti minimi)
- then innervates the **ulnar lumbricals (4th and 5th), all of the dorsal interossei, the adductor pollicis** (major muscle of pinch) and the **deep head of the flexor pollicis brevis** (the rest of that muscle is usually innervated by the median nerve)
- **the sensory nerves to the palmar aspect of the ulnar one and a half fingers** come off the ulna nerve at the base of the palm just beyond the ulna styloid











Branches of the Ulnar Nerve Cont.

- There are **no branches** in the arm.
- **Muscular branches** of forearm supply the **flexor carpi ulnaris** and the medial half of the **flexor digitorum profundus muscles**.
- Most of the intrinsic muscles of the hand

Hand Innervation

- The Palmar Cutaneous Branch
 - supply the **skin on the medial part of the palm**.
- The Dorsal Cutaneous Branch
 - supplies the **posterior surface of the medial part** of the hand.
- The Superficial Branch of the Ulnar Nerve
 - supplies the **cutaneous fibres** to the **anterior surfaces** of the **medial one and a half digits**.

- The Deep Branch of the Ulnar Nerve
 - This supplies the **motor fibres** to the hypothenar muscles, the medial two lumbrical muscles, the adductor pollicis muscle, and the interosseous muscles.
- The ulnar nerve is referred to as the **nerve of fine movements**.

Hypothenar muscles

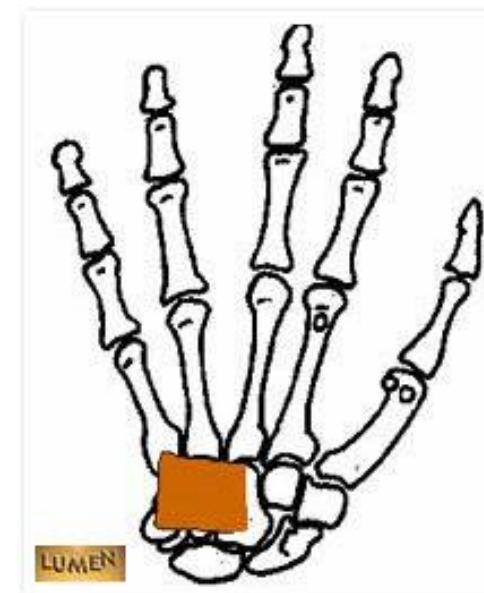
- Abductor Digiti Minimi
- Opponens Digiti Minimi
- Flexor Digiti Minimi
- Palmaris Brevis



**Abductor & Flexor
Digit Minimi**

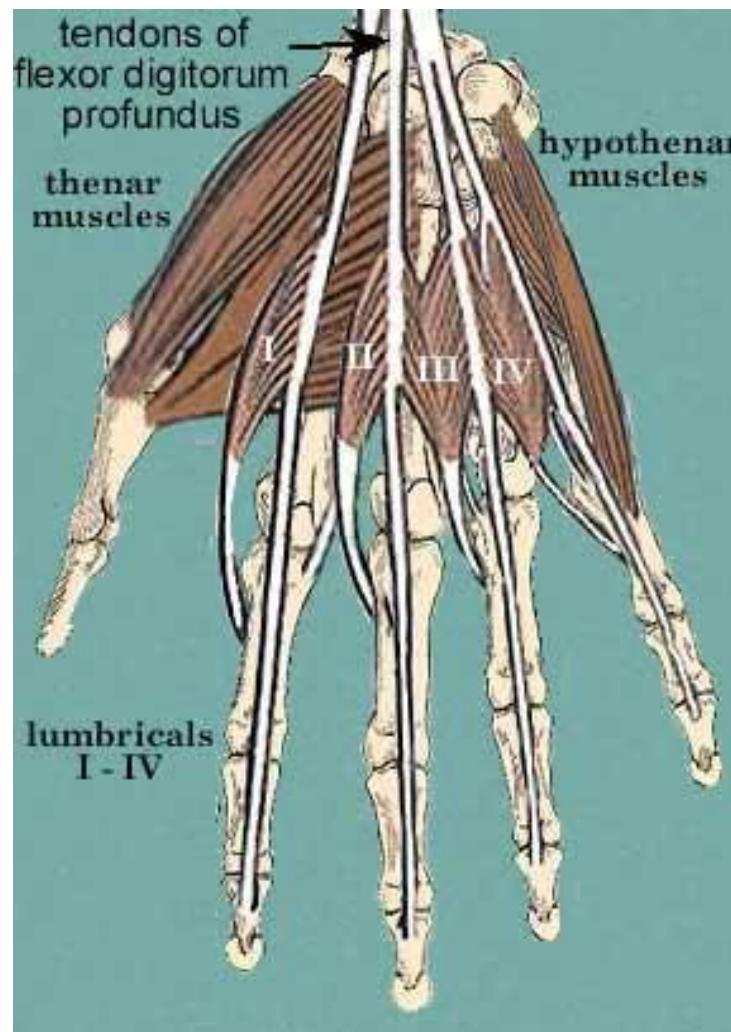


**Opponens Digit
Minimi**



Palmaris brevis

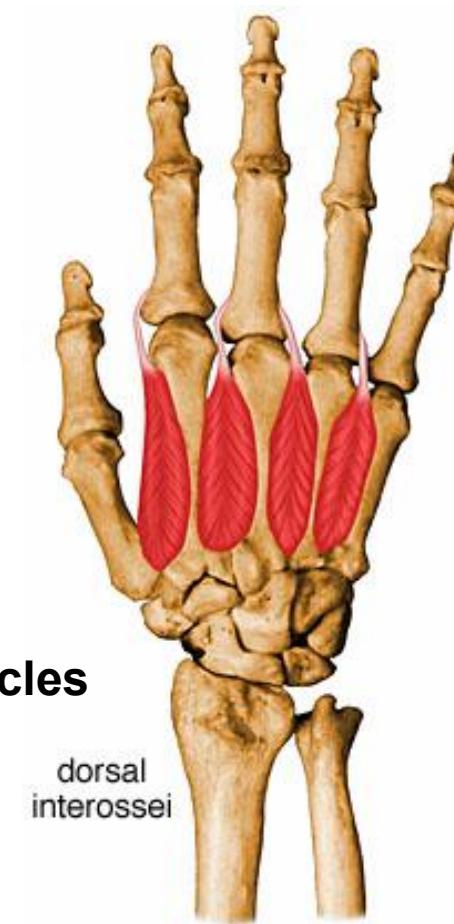
Lumbricals





Adductor pollicis

Interosseous Muscles



dorsal
interossei

The Radial Nerve

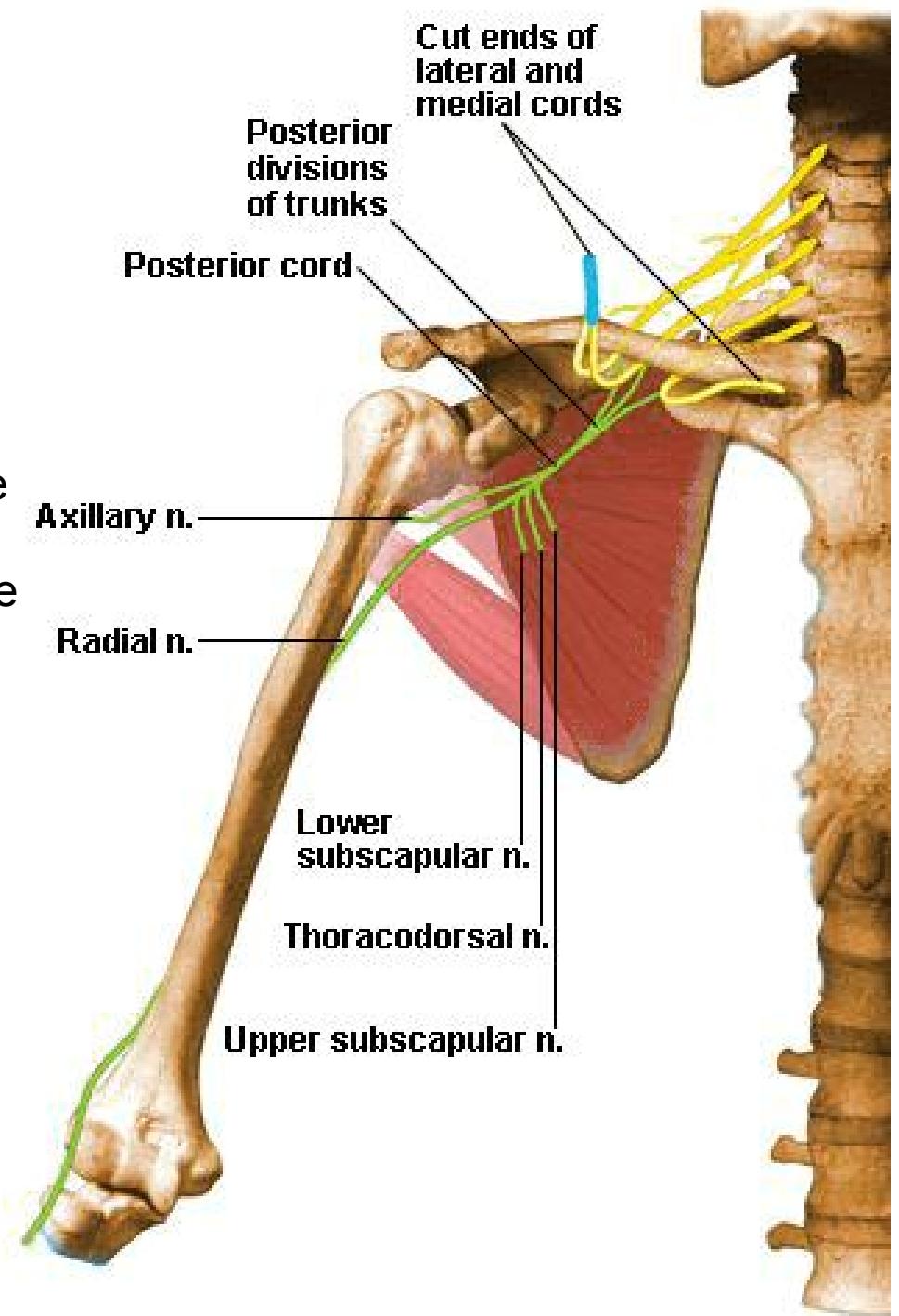
- The radial nerve **descends in the arm** between the brachialis and brachioradialis muscles.
- It crosses the **anterior aspect of the lateral epicondyle**.
- Soon after it enters the forearm, it divides into superficial and deep branches.

The Superficial Branch

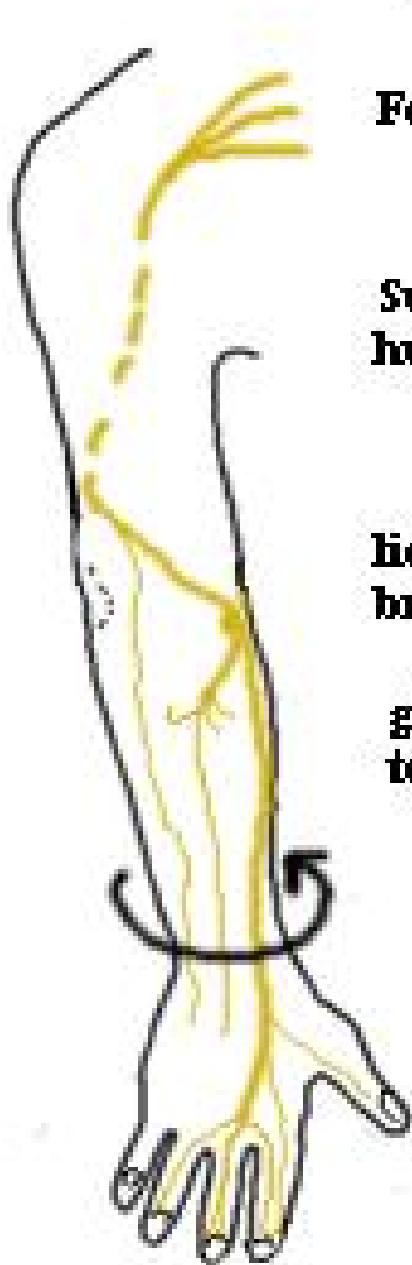
- This is the **smaller of the two branches** and is the **direct continuation of the radial nerve**.
- It passes distally, **anterior to** the pronator teres muscle and under the cover of the brachioradialis muscle.
- In the distal 1/3 of the forearm, the **superficial branch passes posteriorly**, deep to the tendon of the brachioradialis muscle, and enters the **posterior fascial compartment of the forearm**.
- It pierces the deep fascia **3 to 4 cm proximal to the wrist** and supplies skin on the **dorsum of the wrist, hand, thumb, and the lateral 1 (or 2) and a half digits**.

Radial Nerve

- arises from the posterior cord of the brachial plexus, (C5,C6)
- It passes out of the posterior axilla between the long head of triceps and the humerus to **run in the spiral groove on the back of the humerus**, along with the brachial artery.



Radial Nerve



Formed from posterior cord

Supplies triceps and passes behind humerus in spiral groove

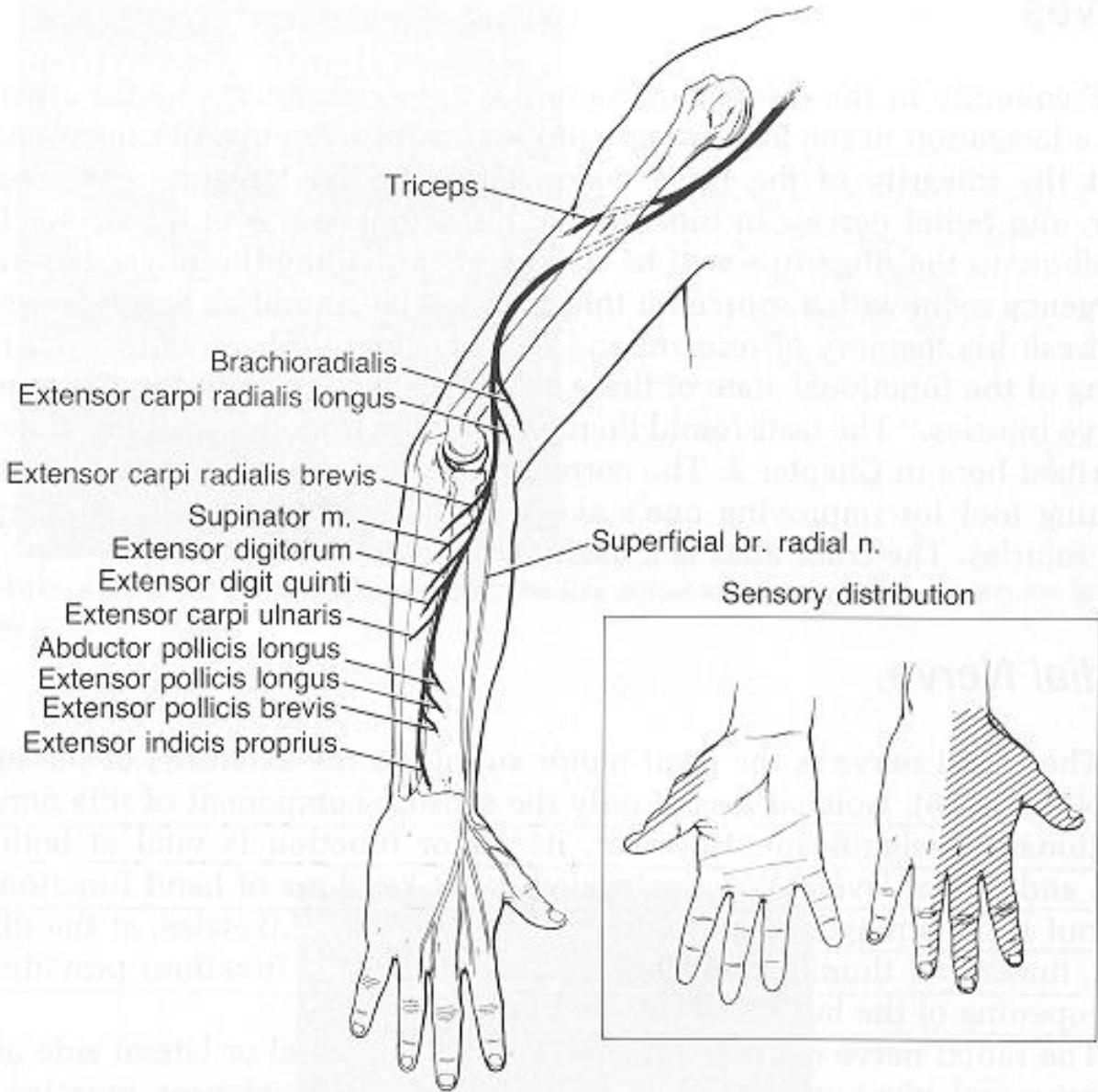
Lies between brachioradialis and brachialis at elbow

Gives off superficial and deep terminal branches

pronated

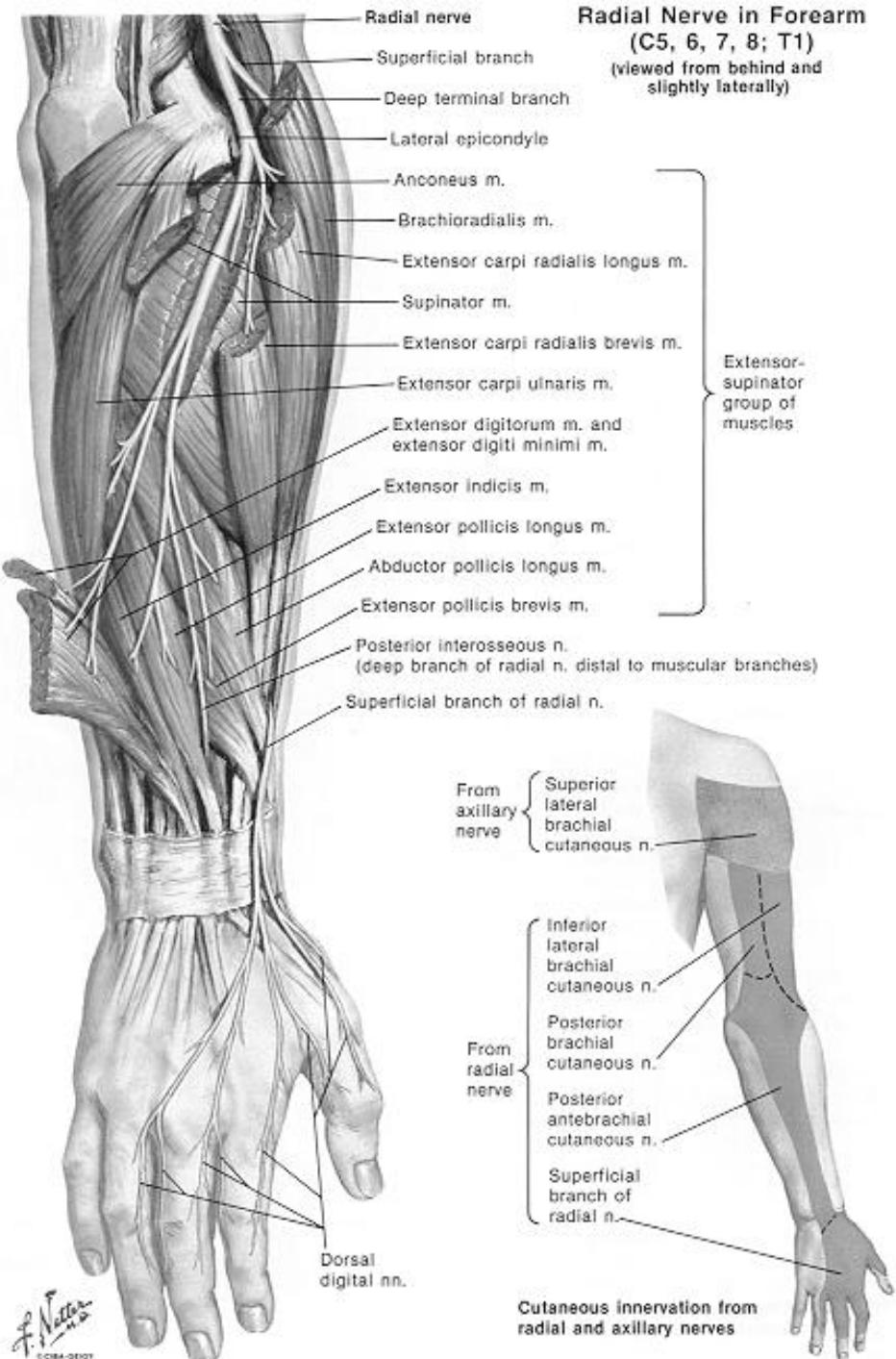
Radial Nerve

- the radial nerve gives off **motor branches above the elbow** to innervate the **extensor carpi radialis longus** and **brachioradialis**
- the radial nerve branches just above (or just below) the elbow into two branches:-
 - the **superficial branch of the radial nerve** that courses with the radial artery and supplies **sensation to the dorsum of the radial hand + motor branch** to the **extensor carpi radialis brevis**;

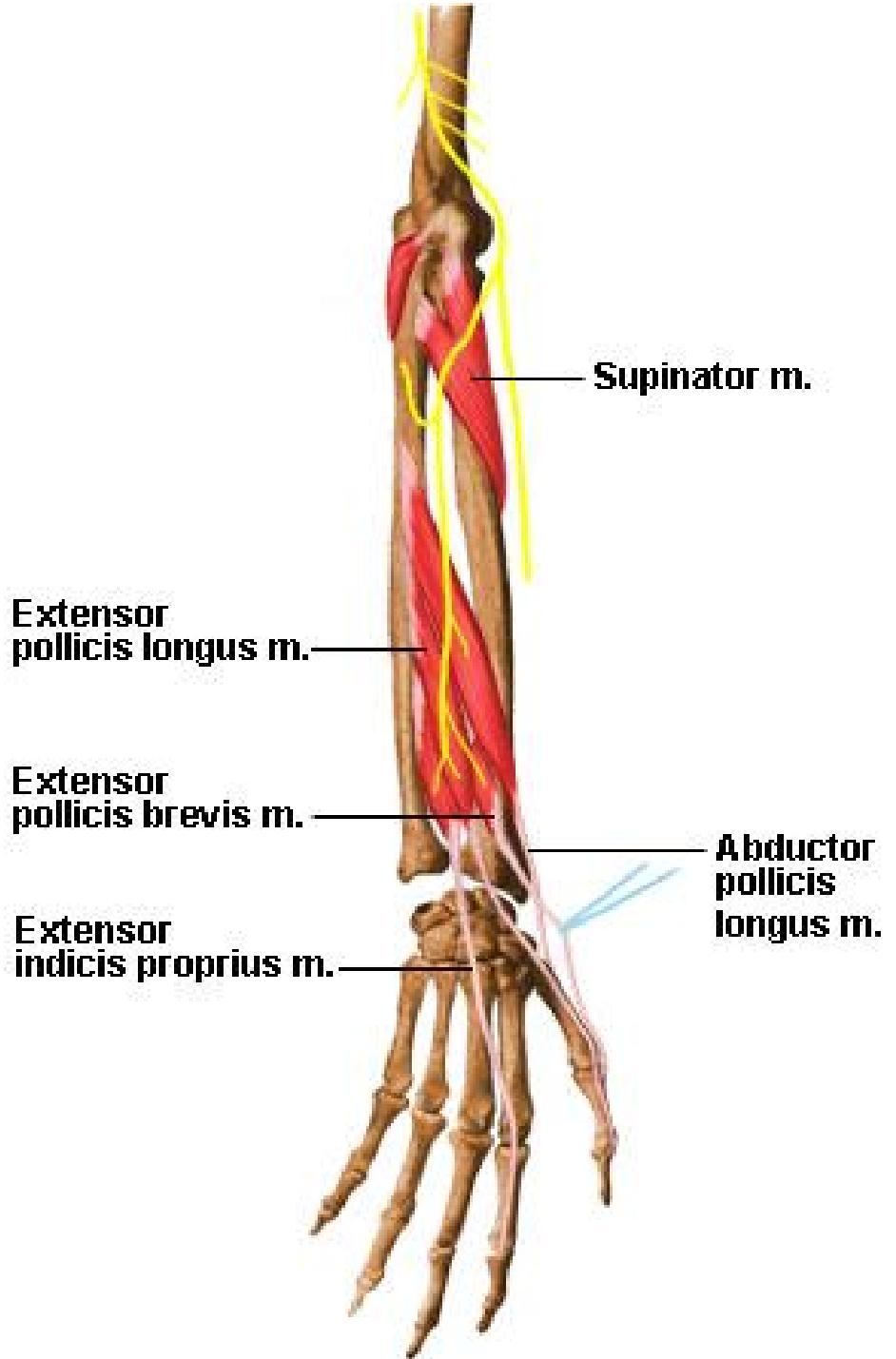


Radial Nerve (cont)

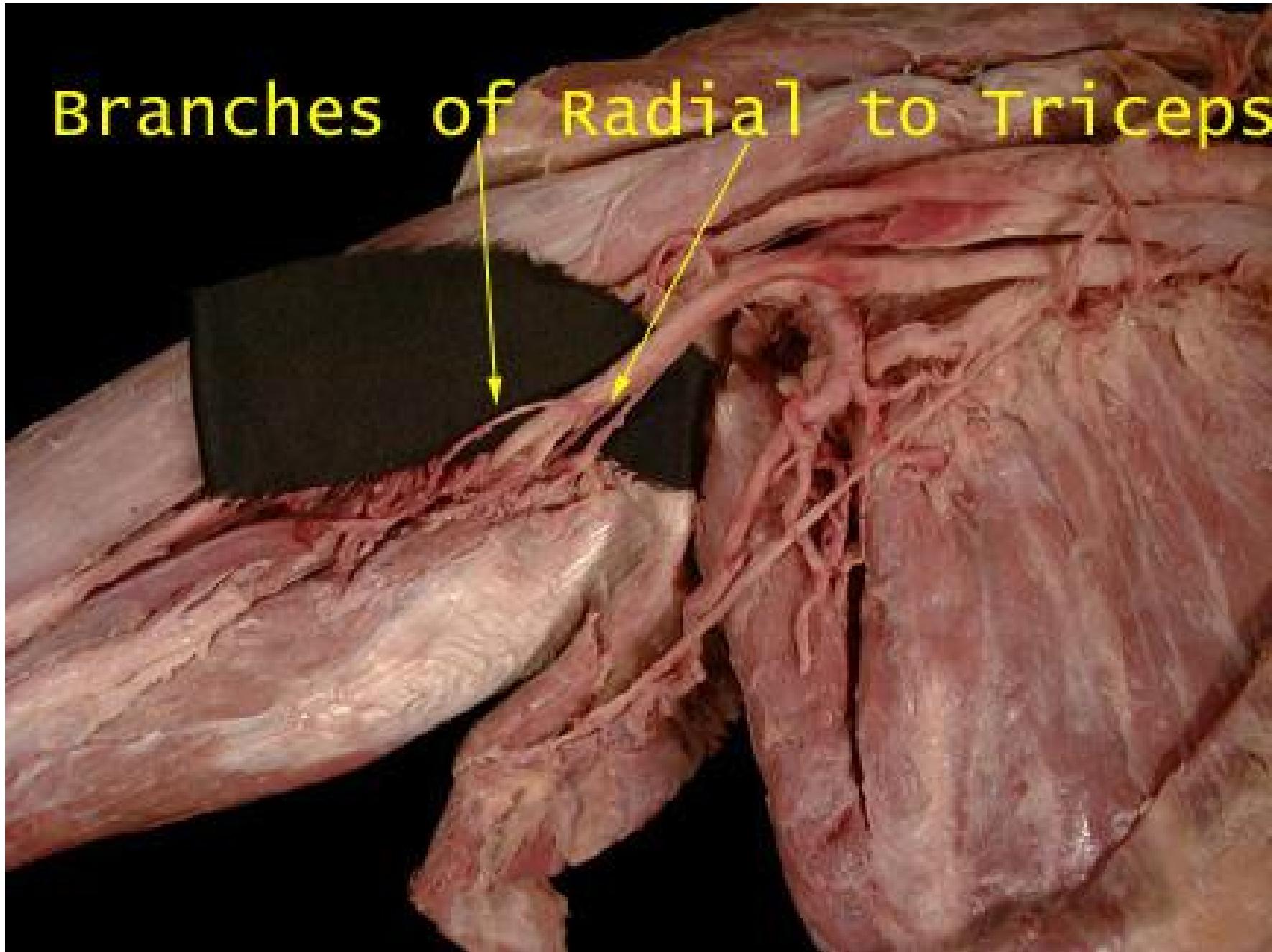
- the posterior interosseous nerve, which sequentially supplies motor innervation to the
 - supinator,
 - extensor digitorum,
 - extensor digiti minimi,
 - extensor carpi ulnaris,
 - abductor pollicis longus,
 - extensor pollicis longus,
 - extensor pollicis brevis
 - extensor indicis proprius



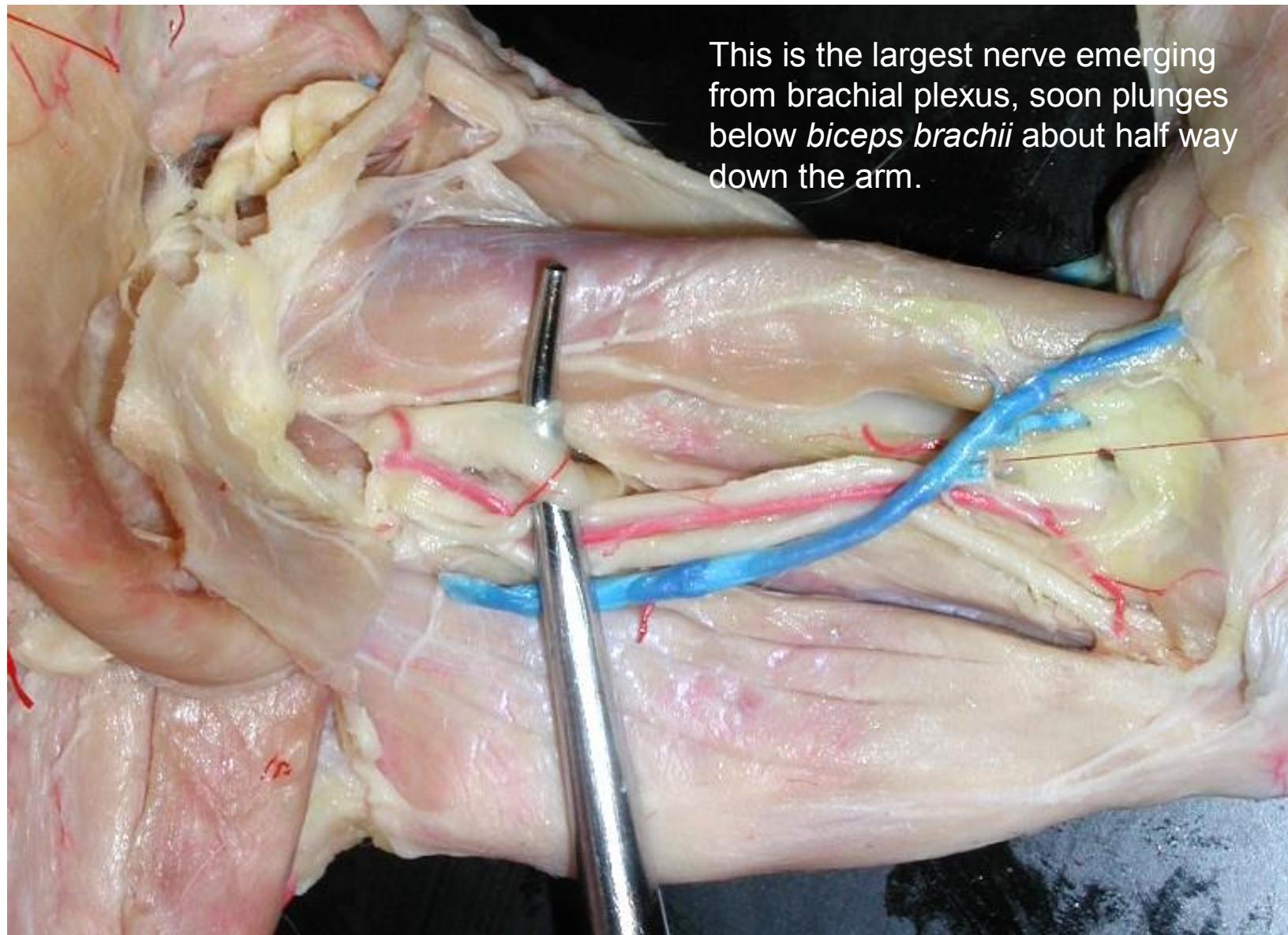
Radial Nerve



Branches of Radial to Triceps



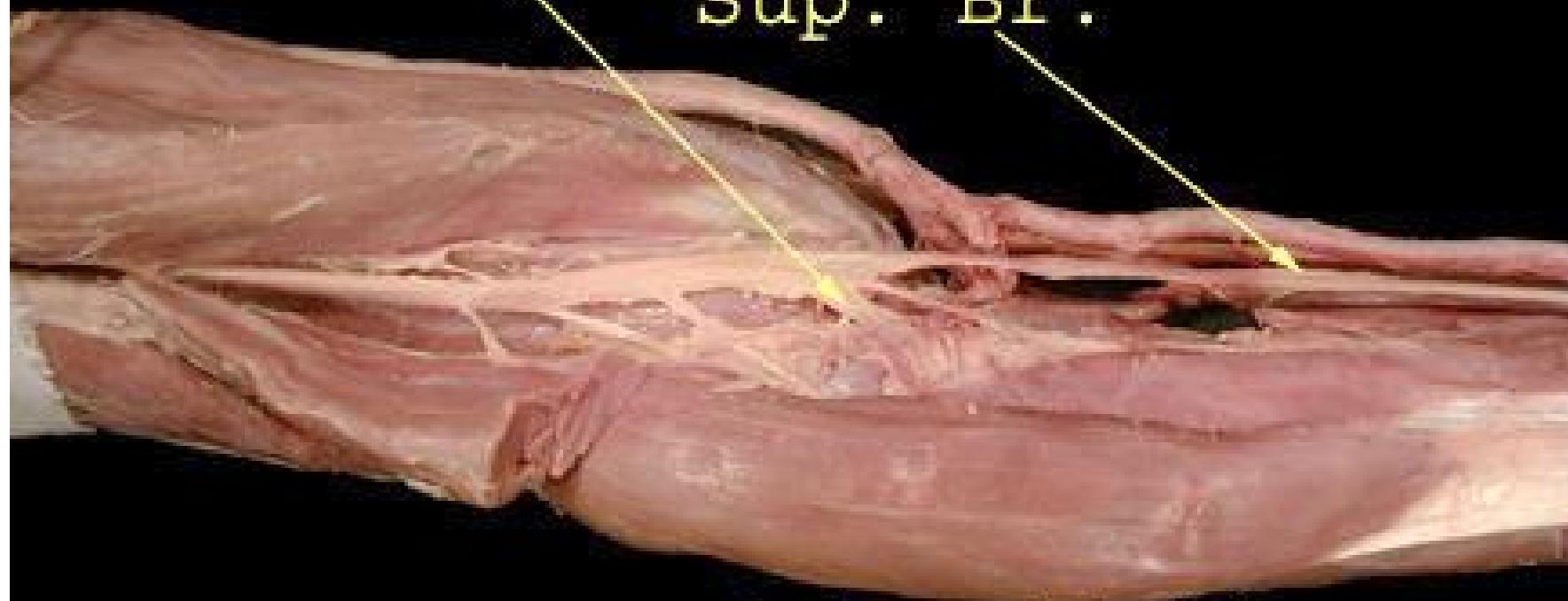
Radial Nerve: Cat



This is the largest nerve emerging from brachial plexus, soon plunges below *biceps brachii* about half way down the arm.

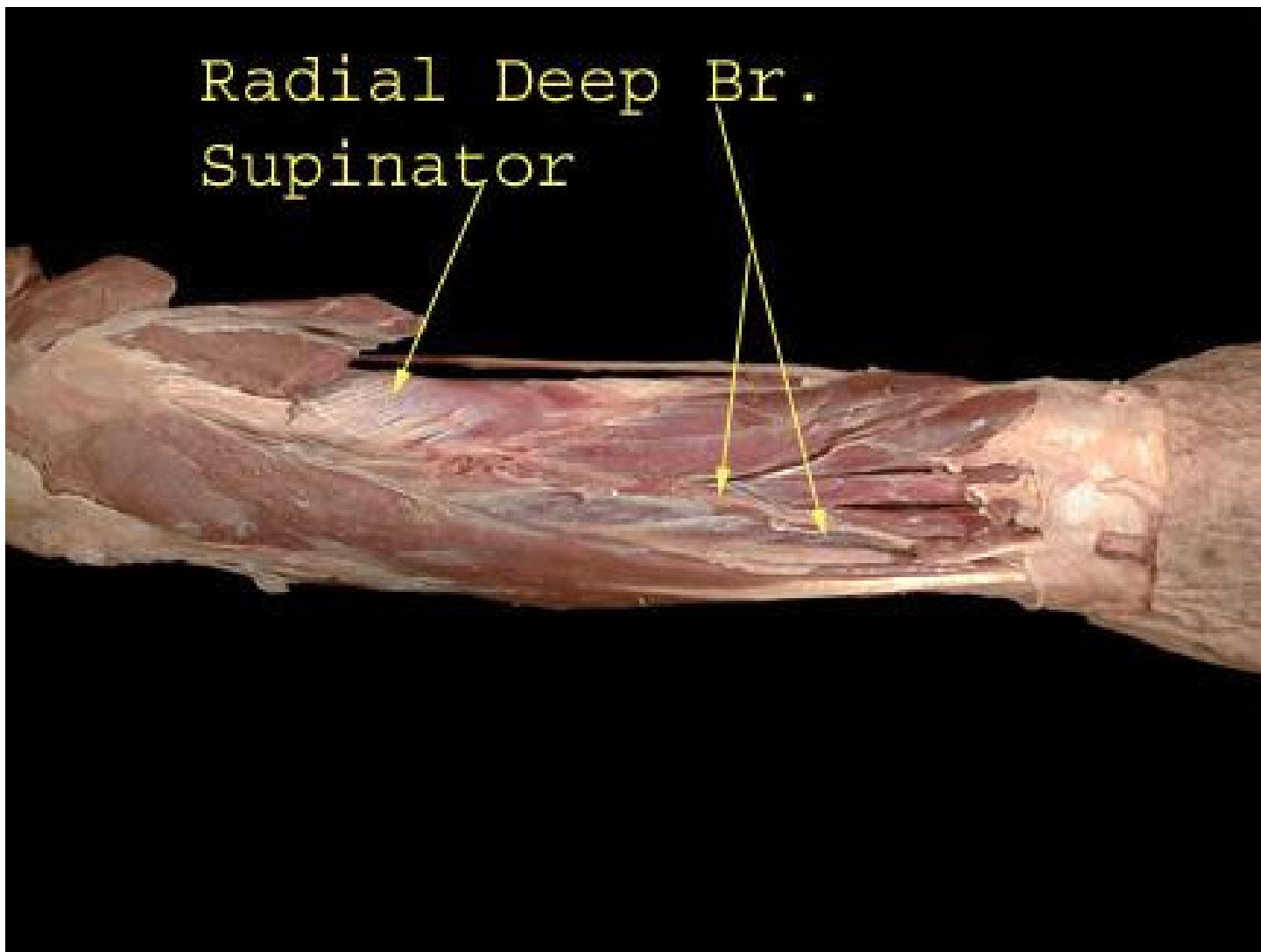
Radial Nerve
Deep Br.

Sup. Br.



Br. to Brachioradialis
Ext. Carpi Radialis L. & Br.

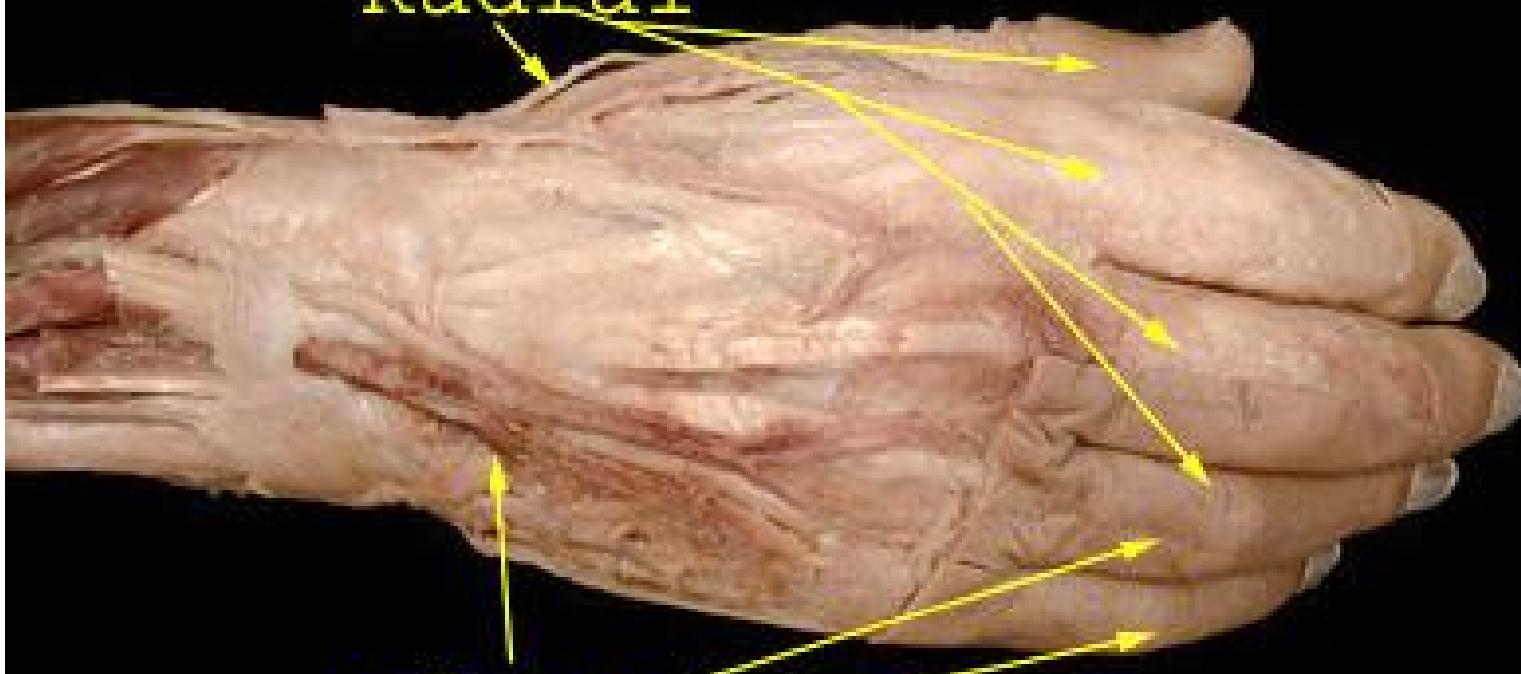
Radial Deep Br.
Supinator



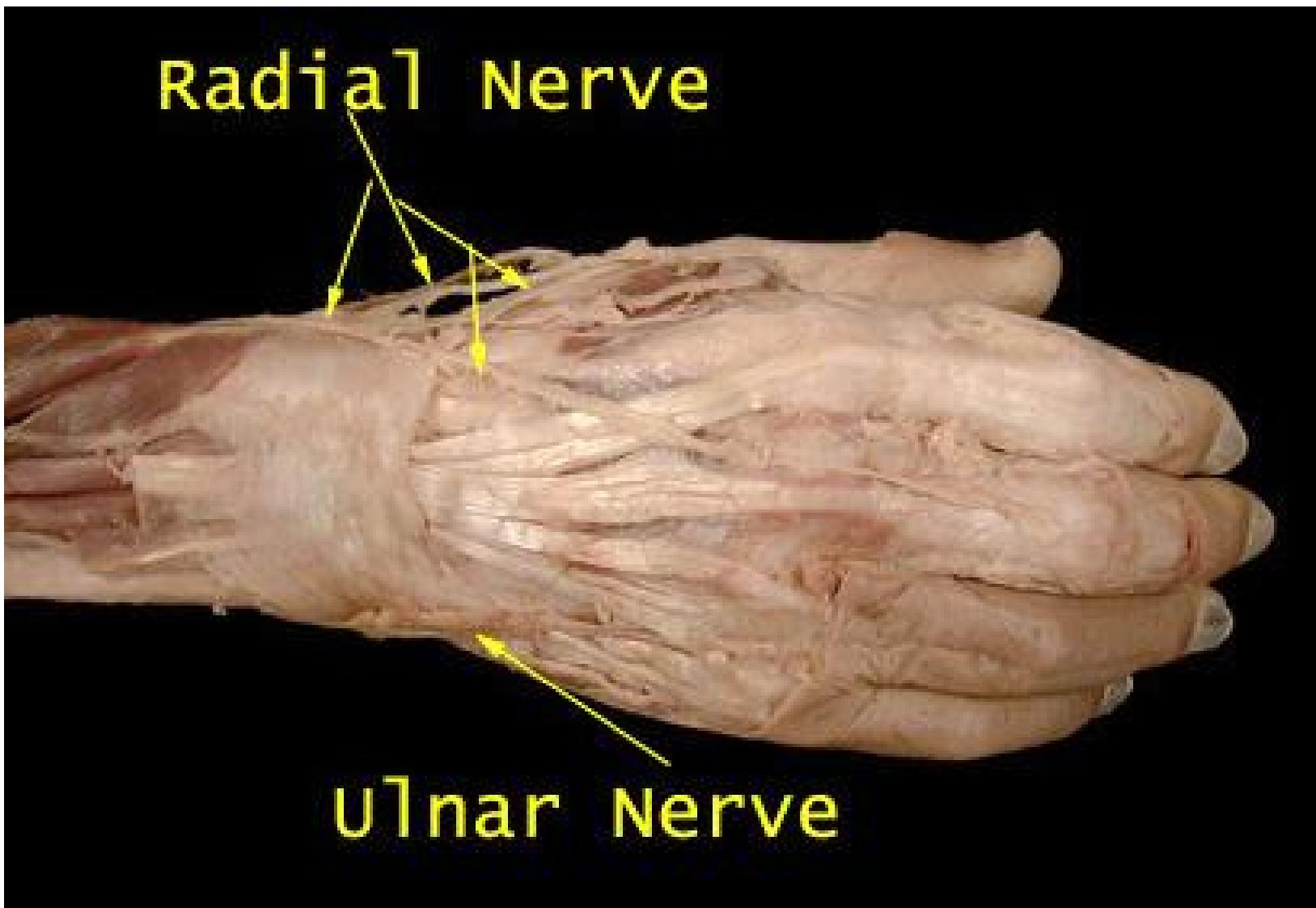
Hand Dorsal Surface

Radial

Ulnar



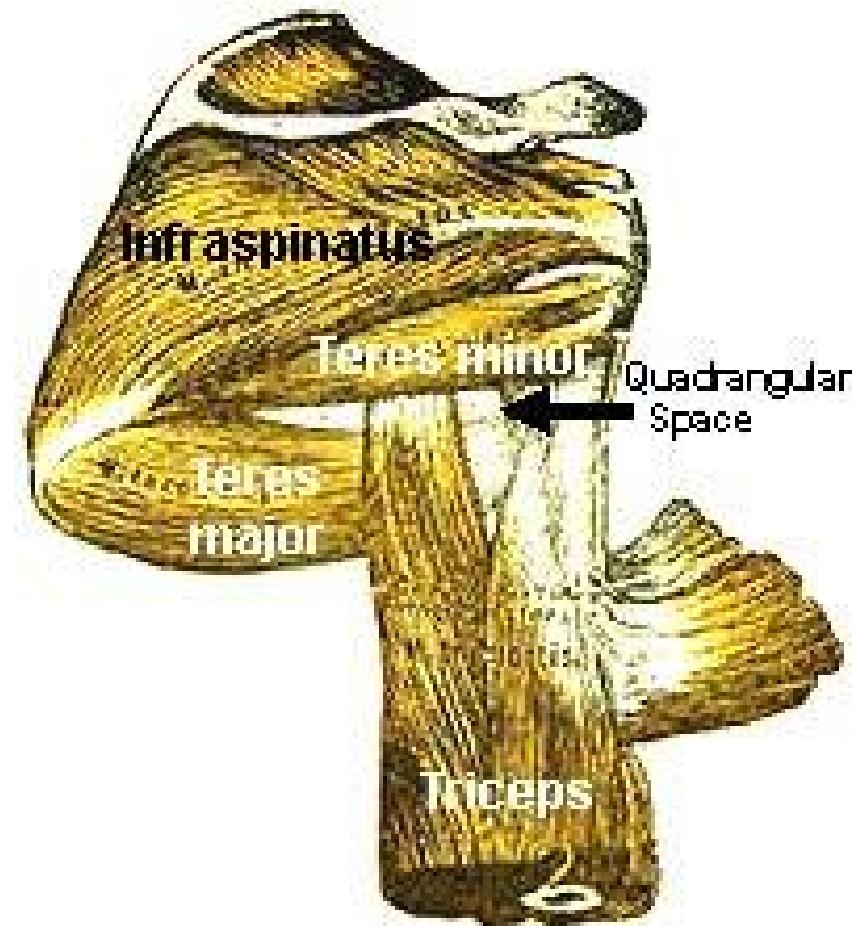
Radial Nerve

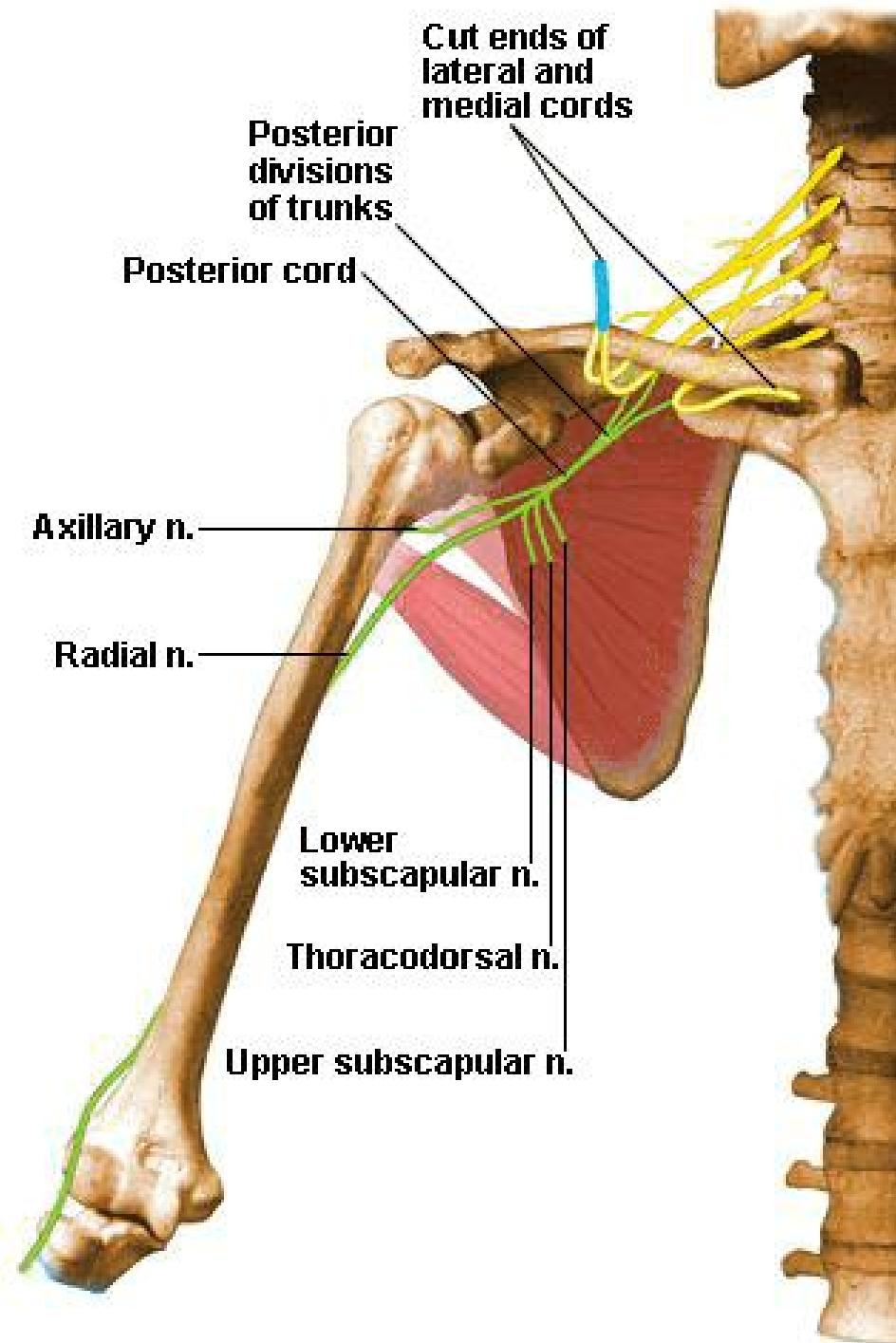


Ulnar Nerve

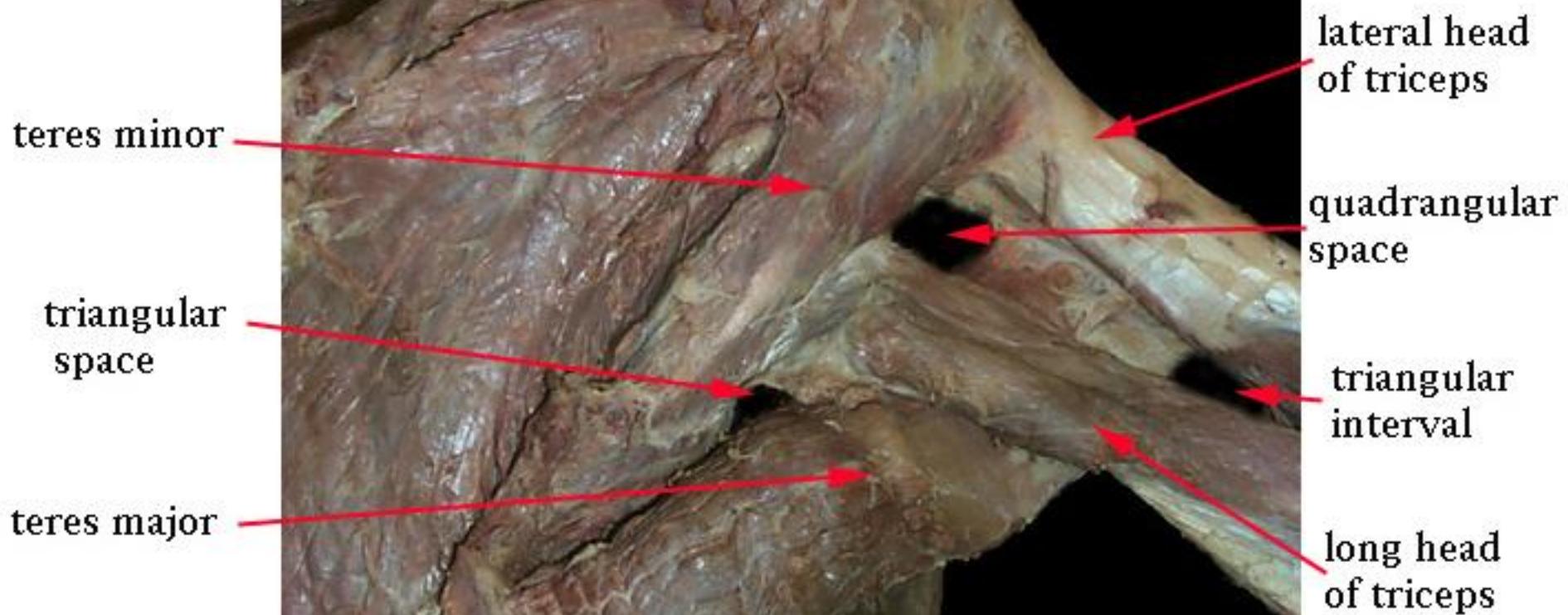
Axillary Nerve: C5, C6

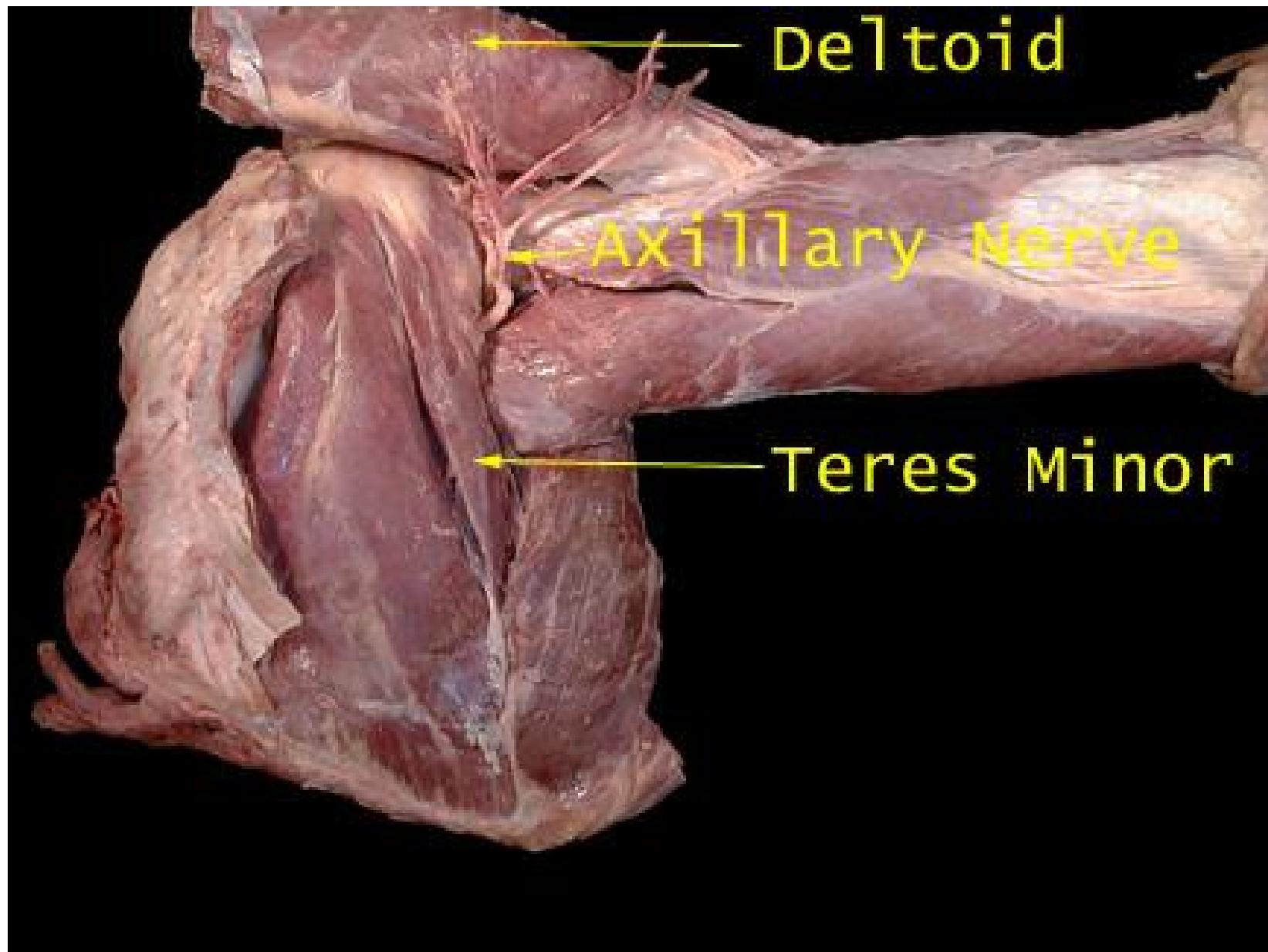
- In the axilla on each side, the **quadrangular space** is bounded by:
 - superiorly:
 - and ventrally: subscapularis
 - and dorsally: teres minor
 - inferiorly: teres major
 - medially: long head of triceps
 - laterally: humerus
- It transmits the:
 - **axillary nerve**
 - posterior circumflex humeral artery
 - posterior circumflex humeral vein
- muscles innervated
 - **teres minor**
 - **deltoid**
- origin
 - posterior division of the trunks of the brachial plexus





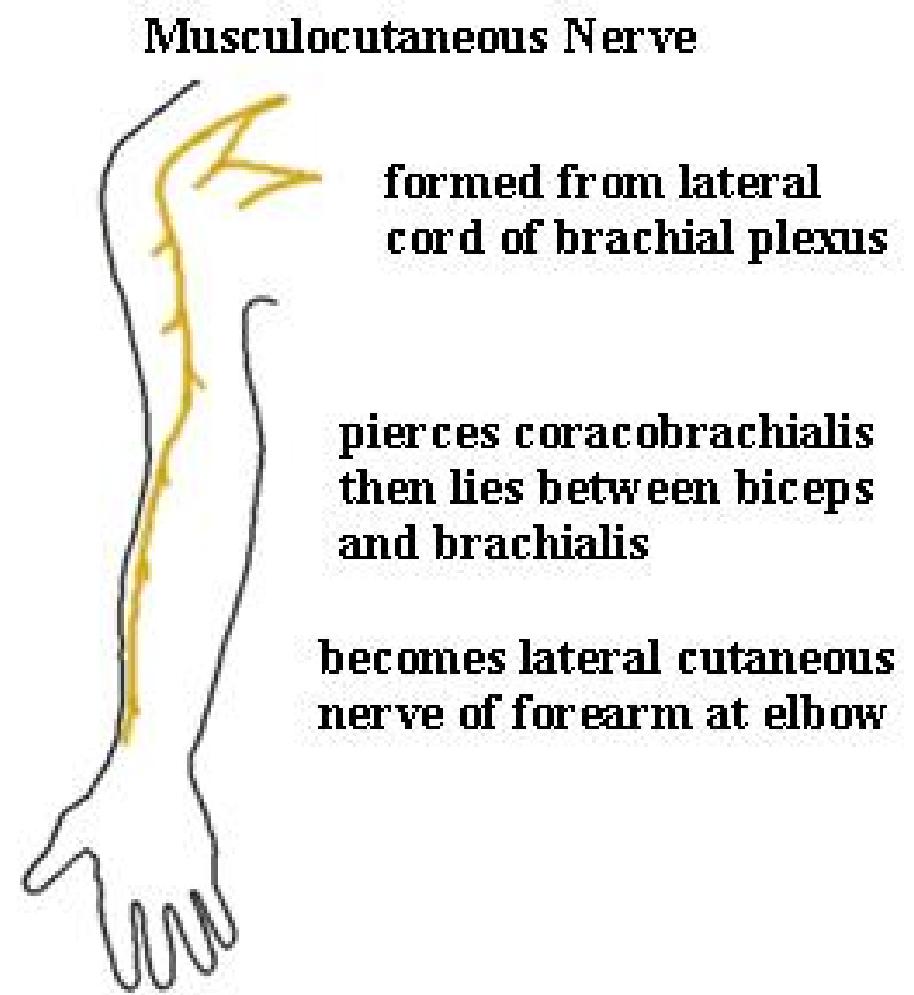
Posterior Shoulder With Arm Abducted





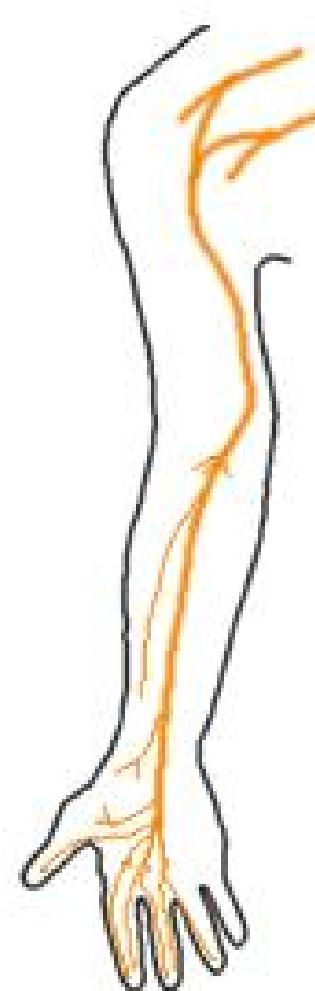
Musculocutaneous Nerve

- The musculocutaneous nerve is formed from the **lateral cord** and contains the C5,6,7 nerve roots.
- The nerve enters the **coracobrachialis muscle** and passes through it to lie laterally between the **biceps and brachialis muscles**.
- The nerve **supplies all three muscles** and terminates as a **sensory nerve** which emerges from the lateral side of the tendon of biceps to **form the lateral cutaneous nerve** of the forearm.



Median Nerve

- formed in the axilla by a branch from each of the lateral and medial cords.
- The two roots of the median nerve arise on either side of the axillary artery and fuse to form the median nerve anterior to the artery.
- midway down the arm it crosses anteriorly to lie medial to the artery.
- passes between the two heads of pronator teres to enter the forearm.
- it supplies **pronator teres, flexor carpi radialis, palmaris longus and flexor digitorum superficialis.**



formed from medial and lateral cords

No branches to arm

Passes into forearm between heads of pronator teres

Gives off palmar cutaneous branch

Passes into hand below flexor retinaculum

- As the nerve passes through pronator teres it gives off the **anterior interosseous nerve** which runs along the interosseous membrane to supply the **flexor pollicis longus, pronator quadratus** and the lateral half of the **flexor digitorum profundus muscles.**

- continues on down the forearm attached to the underside of the flexor digitorum superficialis, and lying on the flexor digitorum profundus.

- gives off the **palmar cutaneous branch** which supplies the central part of the palm and the thenar eminence.

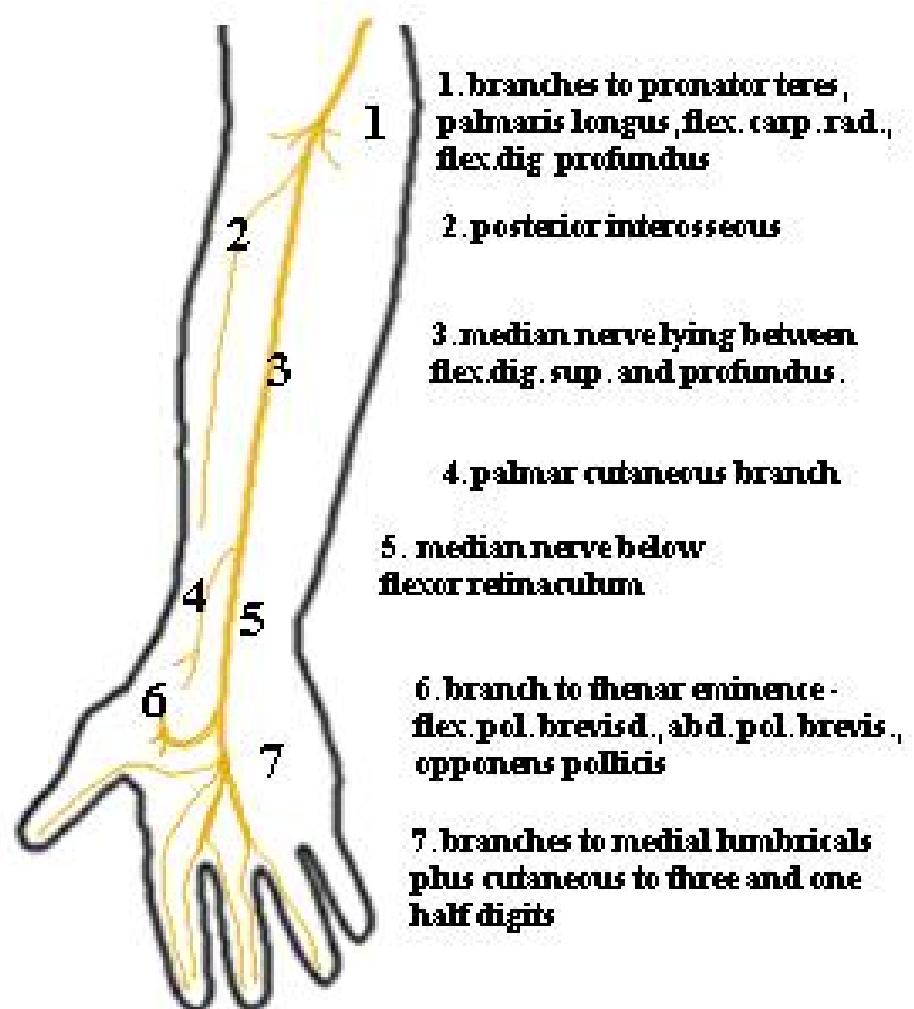
- continues through the carpal tunnel into the hand.

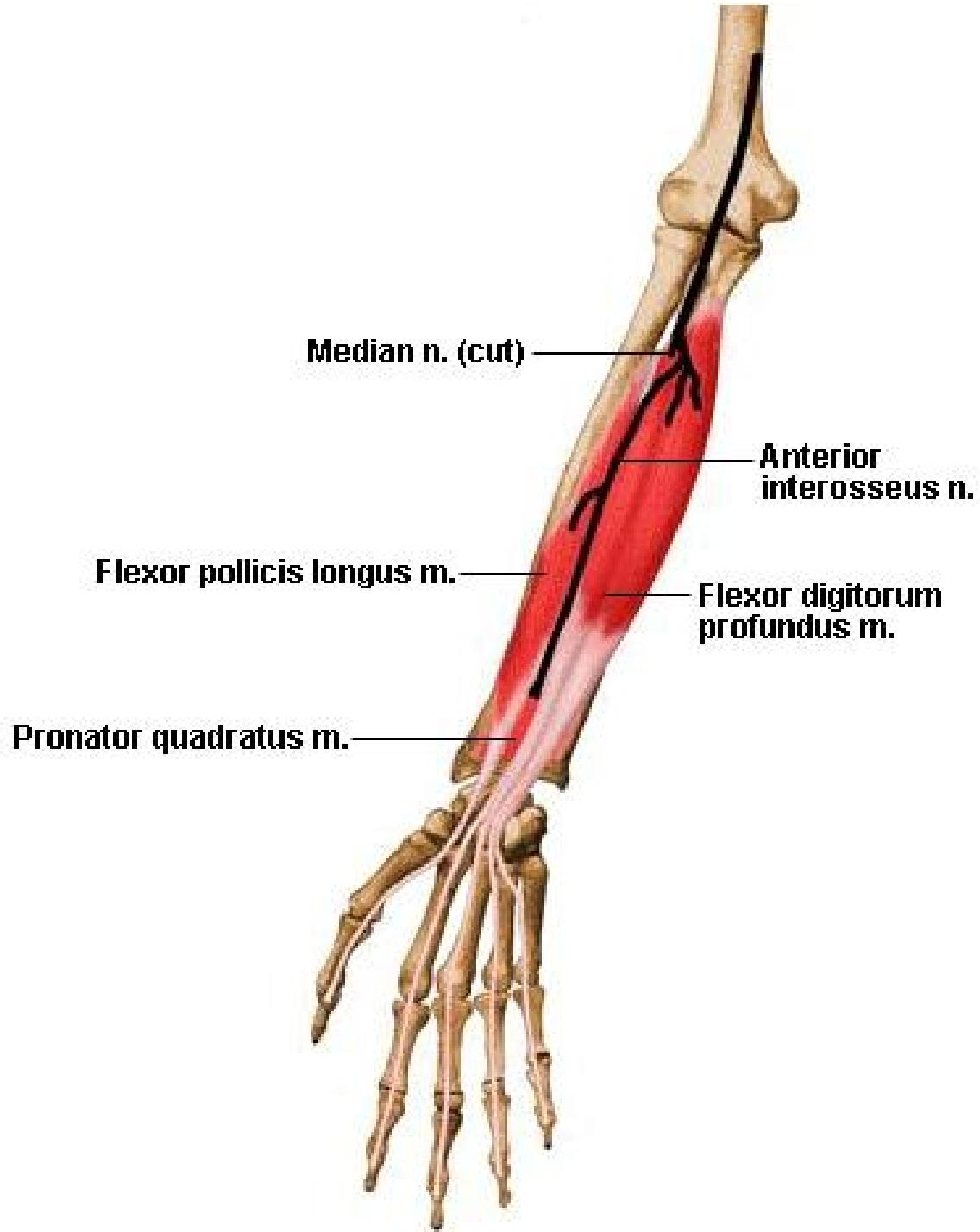
- In the hand the nerve forms a

- **muscular branch** and the- supply the muscles of the thenar eminence.

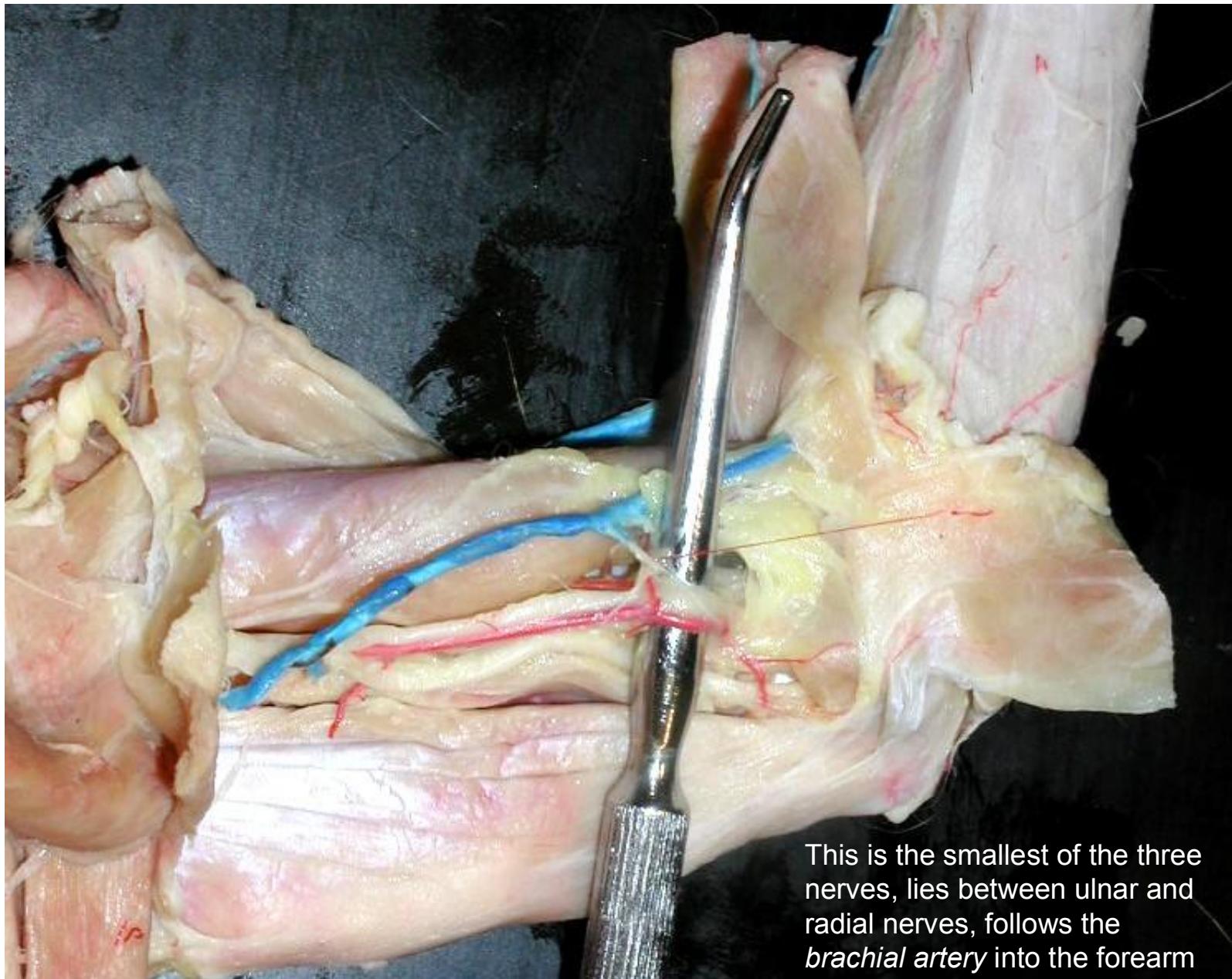
- **palmar digital branches**- supply the palmar surface of the thumb, index and middle finger and the lateral half of the ring finger, and branches to the two lateral **lumbrical muscles.**

Median Nerve





Median Nerve



This is the smallest of the three nerves, lies between ulnar and radial nerves, follows the *brachial artery* into the forearm